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Leading Features.

CLOUDS AND WEATHER IN SOUTHERN RHODESIA.
A.I.V. SILAGE.
RE-NAMING OF SPANISH BUNCH GROUND NUTS.
SOUTHERN RHODESIA GROUND NUTS.
MYCOLOGICAL NOTES.
DAIRY TESTS AND CALCULATIONS.
SECOND LOCUST INVASION, 1932.
NOTES ON AFRICAN ALOES.
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THE RHODESIA

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VOL. XXX.] JANUARY, 1933. [No. 1

EDITORIAL.

Contributions and correspondence regarding subjects affecting the farming industry of Southern Rhodesia are invited. All communications regarding these matters and advertisements should be addressed to:—The Editor, Department of Agriculture, Salisbury.

Egg-laying Test, 1933-34.—The next Southern Rhodesia Egg-laying Test will commence at the Salisbury Poultry Station on 1st March next. All entries must be received on or before the 14th January. Single pen accommodation has been provided, and full particulars, rules and entry forms can be obtained on application from the Chief Poultry Officer, Department of Agriculture, Salisbury.

During the last few tests it has been difficult to accommodate all the birds offered for competition, and intending competitors are therefore requested to submit their applications as soon as possible.

Wheat Exhibition.—The Third Annual Wheat Exhibition of the Enkeldoorn-Umvuma area was held at Enkeldoorn on the 9th December and was opened by the Hon. the Minister for Mines and Agriculture.

There were in all some forty-five entries in the classes for the best bag of milling and seed wheat respectively, as well as a few entries of oats and barley and some twenty entries of sheaves of wheat. The judges were Mr. E. R. Ridgway, of the Rhodesian Milling & Manufacturing Co., Ltd., and Messrs. H. G. Mundy and T. K. Sansom, of the Department of Agriculture. Generally speaking, the quality of the wheat was good, though not better than in previous years. As is usually the case, the greater number of entries were of Early Gluyas wheat, and some of the exhibits of this variety were of outstanding quality. Separate classes were provided for wheat grown under irrigation and for vlei land or unirrigated wheat. Entries of the latter were the more numerous, and as was the case last year the quality of the latter was if anything superior to that of the former.

The award for the best bag of milling wheat on the Show went to a particularly fine exhibit of "Karachi" grown by Mr. H. G. Kok, who also won in the class for the best bag of milling wheat grown on vlei soil. Mr. G. G. Gilfillan secured first prize for the best milling wheat grown under irrigation. The prize for the best bag of seed wheat from vlei land was won by Mr. J. Harvie with a very good sample of "Pusa 4," while Mr. Gilfillan was again placed first for seed wheat grown under irrigation. Mr. W. W. Coetzee took first prize for wheat grown on vlei land with fertiliser, and Mr. W. G. Hamman for the best stool of wheat—"Kenya Governor." Mr. G. G. Gilfillan is to be congratulated on being awarded the silver cup for the exhibitor obtaining the greatest number of points in all classes.

Bushel weights ran high, as may be judged from the following examples:—Best bag of milling wheat grown on vlei soil: 1st prize 68½ lbs., 2nd prize 66½ lbs., 3rd prize 68 lbs. Best bag of milling wheat grown under irrigation: 1st prize 67¾ lbs. per bushel, 2nd prize 69 lbs., 3rd prize 68¾ lbs. Three exhibits gave bushel weights of 69 lbs., while the lowest weight of any exhibit to which a prize was awarded was 66½ lbs. In both cases the first prize for seed wheat grown under irrigation and on vlei land respectively went to exhibits weighing 69 lbs. to the bushel. With one or two exceptions where the grain had been washed—and such exhibits were disqualified—the wheat was thoroughly dry.

The general high quality of the vlei land wheat and its excellent bushel weight speaks well for the future of this line of farming in Rhodesia.

In the afternoon short addresses were given by the Chief, Division of Plant Industry, on "Some Practical Aspects of Wheat Growing," and by Mr. T. K. Sansom, the Plant Breeder, on the progress of his work on "Wheat Improvement."

Rhodes Matopo Estate Bursaries, 1933.—Applications are invited for a limited number of bursaries available for students wishing to take the diploma course at the Matopo School of Agriculture. The bursaries cover boarding and tuition fees (£48 per annum), either wholly or in part, and are tenable for one or two years, commencing from the beginning of the first term, 1933 (16th January).

Applicants must have passed at least the Junior Certificate examination or its equivalent, and must if successful supply before being admitted to the school a medical certificate that they are able to carry out a full year's course of practical work in agriculture.

Bursaries will not be made available for students whose parents are in a position to pay the ordinary fees, and assistance will only be granted to those students who, though qualified, would otherwise be debarred from taking the diploma course.

For further particulars and application forms, apply to The Director, Matopo School of Agriculture, Private Bag 19 K, Bulawayo.

Hand-rearing of Calves.—Under this heading an article will be found in this issue by Mr. C. A. Murray, of the Matopo School of Agriculture.

The information given will undoubtedly be of great interest to all farmers, but has particular bearing on dairy herds.

The rations recommended are those which are in actual use at the Matopo School where they are giving very satis-

factory results. They are planned to produce good commercial calves. It should be mentioned, however, that breeders of pedigree stock or of special stud animals might prefer to supply their calves with a larger proportion of whole milk than that recommended.

Danger of Grazing Sudan Grass.—Owing to a number of mortalities occurring during the 1931-32 season in cattle from grazing on Sudan grass, the New South Wales Department of Agriculture advises farmers to grow Japanese millet instead of Sudan grass for dairy stock.

Considerable investigation has recently been carried out in New South Wales in regard to mortalities in cattle grazing on Sudan grass. As a result, it appears that danger of prussic acid poisoning may exist under certain conditions when cattle are grazed on this crop. This danger appears to be greater in the younger stages of growth of a normal crop, and cattle are possibly more likely to suffer when first placed on the crop than when they are accustomed to it. Greatest danger of grazing the young growth of Sudan grass occurs with young shoots formed during a drought period, or on young growth resulting from rain following a dry spell. The conditions which govern the amount of prussic acid formed are not clearly understood, but it is evident that great variation exists in different crops.

So far no mortalities have been reported amongst sheep grazing on Sudan grass.

Tea Disease in Nyasaland.—Bulletin No. 3 of the Department of Agriculture of Nyasaland records the results of an enquiry into the cause of "tea yellows" by Dr. H. H. Storey, of Amani Research Institute, and Mr. H. Leach, of the Nyasaland Department.

This disease has caused considerable trouble and anxiety to the tea planters in Nyasaland for many years, and the interesting conclusion reached leaves little doubt that it is due to a deficiency of sulphur in the soil and the plant. An application of ammonium sulphate restored badly diseased bushes to a normal condition in a short time, and a series

of field tests with fertilisers containing sulphur proved that both prevention and cure are effected by the sulphate part of the fertilisers. Treatment with ground sulphur was also found to be beneficial. The experiments were adequately controlled, and there is apparently no doubt that the conclusions arrived at are the correct ones. It had been suspected previously that the disease had been caused by a fungus which is found on the root of diseased plants, but the present investigation seems to indicate definitely that this is not the causative agent, but that the fungus only invades the roots after they have become unhealthy due to sulphur deficiency.

As a means of control, it is now recommended to apply 1 oz. of ammonium sulphate to each old plant, and to use ½ oz. to each new plant. The use of kraal manure, which is rich in combined sulphur, is also advocated.

Curing Tobacco by Electricity.—During the 1931 tobacco season, the State Electricity Commission of Victoria carried out experimental work to discover whether electricity would have any special advantages in the curing and drying of tobacco. The results of the first year's work were briefly mentioned in the March issue of the Journal.

It was decided to continue the experimental work through a further complete season. We are indebted to the Electricity Commission for a copy of its final report, which was published at the end of July last year, and we wish to congratulate the State Commission of Victoria on having taken the initiative in this important branch of investigation, and also on the extremely promising results achieved.

Part I. deals with experimental work conducted in regard to tobacco curing and contains a large amount of new material, and is reproduced in this issue as we are sure it will be of interest to all tobacco growers.

Parts II., III. and IV. deal with the design, equipment and operation of electrically fitted barns.

Although these latter are of great scientific and practical interest, it is felt that no provision exists in this country for applying them, and they will not therefore be dealt with

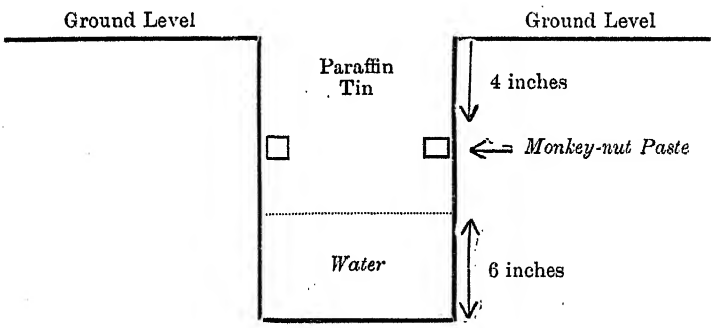
further. Should any tobacco grower, however, be sufficiently interested, a copy of the report will be sent on loan if requested.

An Efficient Rat Trap.—We are indebted to Mr. F. L. Merrington, Enkeldoorn, for the following particulars:—

Mr. E. G. R. Kirton, a prominent wheat farmer of this district, has destroyed 4,302 rats in his wheat lands this season—a period extending over two and one half months.

The accompanying sketch shows the very simple trap used. That it is efficient there can be no doubt.

On the first night, using four traps only, he bagged 282. Twenty-four tins in all were used.



A tin is sunk into the ground. A smear of monkey nut paste is put all round four inches from the rim.

The rat in an endeavour to reach the paste falls into the water.

The paste is prepared by slightly roasting the nuts and pounding up in a mortar.

Erratum.—In the price list of Forest Tree Transplants, etc., issued recently by the Forestry Division, *Datura arborea* (tree tomato) should read *Datura arborea* (tree potato).

Fig. 1. Teaching the calf to drink.

Fig. 2. A well-grown heifer, 6 months old, reared on skim milk.
Weight 350 lbs.

Fig. 3. Heifers should not be neglected after weaning—10 months old

THE HAND-REARING OF CALVES.

By C. A. Murray, B.Sc. (Agric.), M.Sc., Lecturer in Animal Husbandry, Matopo School of Agriculture and Experiment Station.

It is very much more profitable to hand-rear calves than to allow them to suckle their dams. Figures published* by the Division of Dairying in the Union show that the average production of 11 cows while suckling their calves was 86 lbs. butterfat, and for the same cows during the next lactation, when their calves were hand-reared, 239 lbs. butterfat. The increased production per cow in favour of hand-rearing was therefore 153 lbs. of butterfat, worth £6 7s. 6d. at 10d. per lb.

In addition to being a very much more profitable practice, hand-reared calves (if properly cared for) are generally more healthy, suffer less from scours and turn out much more docile cows than ones raised on their dams.

Calves to Rear.—Do not rear bull calves (except for stud purposes) nor inferior heifer calves. Also, discard undersized, weak calves at birth unless very valuable from a breeding point of view. Rear only heifer calves from the better cows, sired by a good bull.

To maintain a herd without buying cows at least three heifers for every ten cows in the herd should be reared annually. It may be profitable to rear a considerably larger number if the herd is to be increased, or severe culling is practised, or if there is a good market for surplus stock.

Preparation of the Cow for Calving.—Calf-rearing begins before the calf is born, i.e., with the care of the pregnant dam.

If the cow is still milking, it should be dried off six to eight weeks before calving. During her dry period, if she

* Hardy, E. G.—Bulletin 34, 1927. Department of Agriculture, Union of South Africa.

is down in condition, feed her well so that she may recuperate from the previous lactation, build up a supply of body reserves and nourish the unborn calf. Depending on her condition, give her some good quality roughage, such as legume hay and silage, and if necessary some concentrates in addition. In summer, good grazing will usually be sufficient.

At calving time give the cow careful attention. See that her bowels are loose. Do not calve in dirty kraals or stables. In summer a small grassy paddock with ample shade and shelter is an ideal place for calving. Although the cow will usually require no assistance, some one should always be available in case of necessity.

Management of the Young Calf.—

Care of the Calf after Birth.—Leave the calf with the cow until it has been licked dry. Generally the best results will be obtained by taking it from its dam ten to twelve hours after birth. During the first four days of its life always feed the calf its dam's milk, i.e., the colostrum. This is very important, as it acts as a laxative, cleans out the digestive tract and assists in preventing digestive troubles.

Teaching the Calf to Drink.—Before attempting to teach a calf to drink, allow it to become hungry by not feeding it for ten to twelve hours after taking it from its dam. Then back it into a corner, stand astride its neck and let it suck the fingers (see Fig. 1). While sucking, gradually lead its head into the bucket, and as soon as it starts taking some milk withdraw the fingers slowly. After two or three lessons in this way the calf will drink readily from a bucket.

De-horning.—Horns do not increase milk production. They are fancy points interfering with the commercial value of a herd. De-horned cows are more docile, easier to handle and return better profits.

De-horning is a very simple operation, and should be done when the calf is two to five days old. The horn "buttons" can be felt easily at this stage. With a pair of scissors clip the hair short over each "button," and with a stick of caustic potash slightly moistened rub hard on each "button" until red and just about to bleed. That is all that is required. The only precaution necessary is to keep the

calf out of rain for a few days to prevent the caustic potash from running into its eyes. (Sticks of caustic potash can be obtained at a very low cost from all chemists. Care should be taken not to touch it with the hand.)

Regularity and Cleanliness.—The calf, like its dam, is a creature of habit and soon becomes accustomed to a given routine. Any interruption in this routine will upset the calf. Therefore, feed the calf at the same time each day, give it milk at the same temperature, and make all changes in ration as regards quantity and quality gradually.

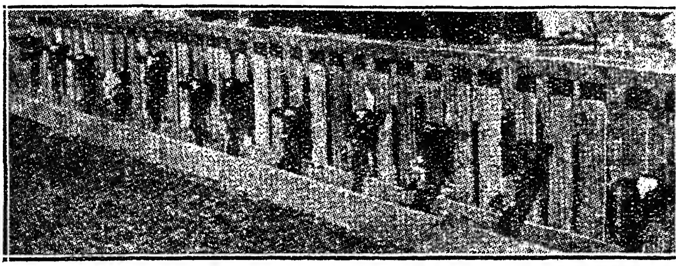


Fig. 4. Calves in stanchions, after Davis' "Productive Farming."

Keep the pens, buckets and other equipment scrupulously clean, and protect the small calf against rain and draughts. These are all fertile sources of calf diseases and should be guarded against.

Management and Housing.—For the first two or three weeks it is best to keep the calf in a small, dry, well-bedded pen. From then on it may be allowed out both day and night, depending on the weather. Do not allow calves under six months of age out in rain or very cold weather. A small paddock with good grazing, water and shelter close to the pens is very desirable.

Although individual pens are best, they are not always possible. A lean-to shelter, protected from wind and draughts, kept dry and well bedded, will serve the purpose. A pen 16 ft. x 10 ft. will be large enough for seven to nine calves. To facilitate feeding and prevent the calves from sucking each other's ears and udders, a stanchion should be built along one side (see Fig. 5). In front of the stanchion a partitioned feed trough should be provided for the buckets

to stand in and in which the grain may be fed. This arrangement will prevent the buckets from falling over and will ensure each calf getting its share of concentrates. Against the back of the pen a hay-rack should be fixed.

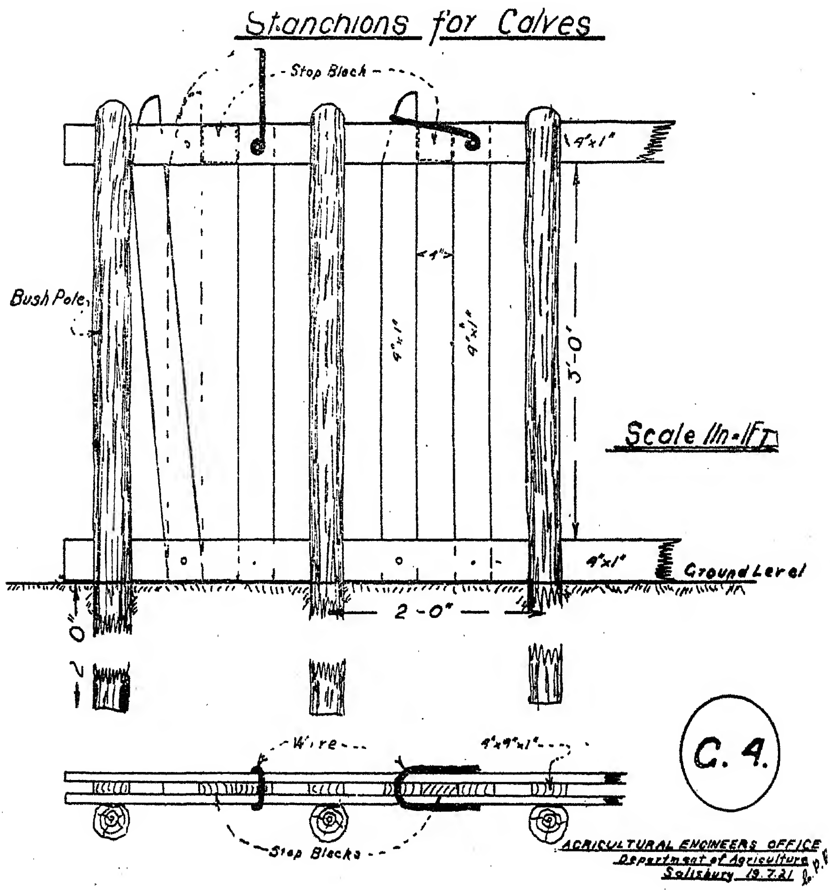


Fig. 5. Diagram of calf stanchions.

Feeding the Calf.—Unless the calf is unduly small or weak, two feeds a day are quite sufficient. Always give the milk in clean buckets at blood-heat temperature. Do *not* feed cold milk. During the first four days give the calf its dam's milk. This is essential. Rather under feed than over feed. Over feeding causes scours, and this will set the calf back for weeks or months.

Offer Grain and Hay Early.—From about the 8th day the calf will start nibbling at hay. Always give it access to *good quality* hay from a rack. Do not give mouldy or poor quality hay. From the second week encourage it to eat concentrates. This may be done by rubbing a little of the concentrate mixture on its nose or by putting a little in the bucket after the calf has finished its milk. Always feed the concentrates *dry*. Do *not* feed concentrates boiled, soaked or in the form of a slop.

Raising the Calf on Skim-milk.—From the beginning of the third week gradually substitute skim-milk for whole milk, so that at the beginning of the 7th week the calf will receive skim-milk only. Always make the change from whole milk to skim-milk gradually.

Feeding Schedule.—The following feeding schedule has been found very satisfactory (see figure 2) at the Matopo School of Agriculture:—

1st week: $\frac{3}{4}$ gallon (6 pts.) whole milk per calf per day.

2nd week: 1 gallon (8 pts.) whole milk per calf per day.

3rd week: 1 gallon (8 pts.) whole milk p.c.p.d., plus $\frac{1}{4}$ gallon skim-milk.

4th week: $\frac{3}{4}$ gallon (6 pts.) whole milk p.c.p.d., plus $\frac{1}{2}$ gallon skim-milk.

5th week: $\frac{1}{2}$ gallon (4 pts.) whole milk p.c.p.d., plus $\frac{3}{4}$ gallon skim-milk.

6th week: $\frac{1}{4}$ gallon (2 pts.) whole milk p.c.p.d., plus 1 gallon skim-milk.

7th week: $1\frac{1}{2}$ gallons skim-milk.

8th to 20th weeks: $1\frac{1}{2}$ gallons skim-milk.

21st week: 1 gallon skim-milk.

22nd week: $\frac{3}{4}$ gallon skim-milk.

23rd week: $\frac{1}{2}$ gallon skim-milk.

24th week: $\frac{1}{4}$ gallon skim-milk.

Calves fed according to the above schedule will do well if supplied in addition with good quality veld hay as roughage and with up to 4 lbs. daily of practically any one or a combination of several of our farm-grown grains. The following are a few practical concentrate rations:—

1. Crushed maize.
2. Equal parts of maize meal and kaffir corn meal.
3. Equal parts of maize meal and ground oats.
4. 4 parts of maize meal and 1 part of ground beans.

(To each of these mixtures should be added 2% salt.)

Where only a limited amount of skim-milk is available, it may be cut down or cut out altogether after the 12th week. However, when this is done, legume hay should be fed and some protein-rich feed included in the concentrate ration. The following are satisfactory mixtures under these circumstances:—

1. 3 parts maize meal and 1 part peanut meal.
2. 3 parts maize meal and 2 parts bean meal.

(To these mixtures 4 per cent. bone meal and 1 to 2 per cent. salt should be added.)

• Kaffir corn or oats may be substituted for part of the maize.

Raising the Calf Without Skim-milk.—Farmers selling whole milk in towns or to cheese factories usually have no skim-milk available, and are naturally anxious to sell a maximum quantity of whole milk and use as little as possible for calf feeding. Under such conditions a system of feeding known as the "Limited Whole Milk Method" is recommended.

Limited Whole Milk Method.—Under this method of feeding the calf is given a good start on whole milk for the first 60 to 70 days and is then fed on a high protein concentrate mixture and good quality legume hay.

Milk Feeding.—From 40 to 60 gallons of whole milk are required during the 60 to 70 day period of milk feeding. Give approximately a gallon of whole milk per calf per day from the 2nd week, and towards the end of the feeding period reduce so that none is given after 60 to 70 days.

Feed a Well-balanced Concentrate Mixture.—As no skim-milk (which is high in protein and mineral matter) is fed, see that the concentrates contain sufficient of these nutrients. Also include some animal protein in the mixture. The following concentrate mixture has been found very successful at the Matopo School of Agriculture:—

150 lbs. maize meal.
50 lbs. peanut oil cake meal.
50 lbs. wheaten bran.
25 lbs. blood meal.
5 lbs. di-calcium phosphate.
5 lbs. salt.

It is very essential that the calves raised according to this method should be encouraged to eat sufficient of this mixture at an early age. During the first four months give all the grain they will eat, but from the fifth month limit it to 5 lbs. per calf per day.

Feed Legume Hay.—Do not give veld hay or other carbonaceous hay to calves raised on the limited whole milk method. Give only *good quality*, leafy, legume hay, such as lucerne hay, cowpea hay or dolichos bean hay. Give the calves all the hay they will eat.

Feeding the Young Heifer.—Do not neglect the calf after the 6th month. If good summer grazing is available, no extra feed will be required at this stage, except on very poor veld. In winter, depending on the feeds available, one of the following rations will prove satisfactory:—

1. Legume hay and silage or other succulents such as sweet potatoes, majordas, etc.—as much as they will take. This will be about 5 to 10 lbs. legume hay and 10 to 20 lbs. succulence daily. For animals under 10 months give 2 lbs. crushed maize daily in addition. After 10 months the two roughages alone will be sufficient (see figure 3).

2. When no legume hay is available, but only succulence as above and veld hay, or maize stover, a satisfactory ration is one of hay and succulence *ad lib* and 1 lb. of peanut meal daily in addition.

3. When legume hay only is available and no succulence, allow the hay *ad lib* and give 2 lbs. crushed maize daily in addition.

4. With veld hay or maize stover available and no succulence, allow hay *ad lib* and give 3 lbs. daily of a mixture of equal parts of maize meal and peanut meal in addition.

Of the above rations, No. 1 is the most practical and economical.

WITCH WEED CONTROL.

A PROGRESS REPORT.

By S. D. TIMSON, M.C., Dip.Agric. (Wye).

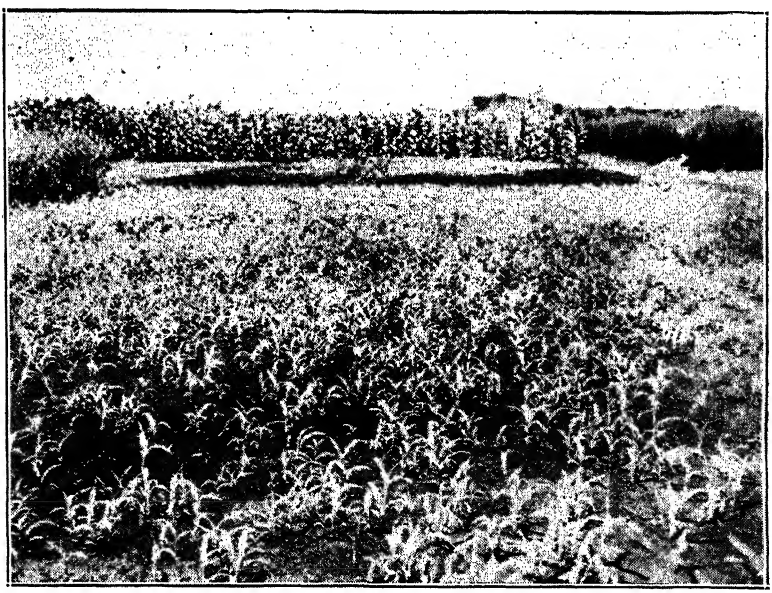
In an article published in the December, 1931, issue of the *Rhodesia Agricultural Journal*, some account was given by the writer of preliminary trials of spraying as a means of control of witch weed carried out on Craigengower Farm, Glendale, and at the Agricultural Experiment Station, Salisbury. The results of these trials were sufficiently encouraging to warrant further and more extended tests being carried out during the past season (1931-32). These were again conducted on Craigengower by the co-operation of Mr. A. G. McCall, the owner.

Preliminary Trial.—Before the commencement of the large-scale trial a small-scale experiment was tried to test further the killing efficiency of solutions of sodium chlorate of 1½ per cent. and 1 per cent. strengths. Duplicate plots were sprayed with each strength, and both the 1½ per cent. and 1 per cent. strengths were found to give a 100 per cent. kill, but the 1 per cent. strength was slow in action, and it was decided that under ordinary farm conditions this strength was too weak to give a margin of safety when the work is carried out by natives. It was therefore decided to use 1½ per cent. strength for the main trial, and this strength of sodium chlorate solution (1½ lbs. in 10 gallons of water) can be recommended for general adoption.

Main Trial.—A field of 100 acres was divided into two portions "A" and "B" of 47 acres and 53 acres each respectively. On portion "A" the witch weed was controlled by spraying with a 1½ per cent. solution as above

RESULT OF TRAP-CROPPING WITH SUDAN GRASS ON 30-ACRE FIELD ON BRAWLANDS, GLENDALE.

1930. Maize—yield reduced to under two bags per acre by witch weed.
1931. Sudan grass hay crop--cut at two months old, and stubble ploughed under.
1932. Maize—yield 14.76 bags per acre. No fertiliser applied.



Second crop of white kaffir corn planted immediately after first crop ploughed under when two months old. Sown 23rd January, 1932. Photographed 15th February, 1932. Seeding rate, 40 lbs. per acre.

described, and on portion "B" the parasite was removed by light hand-hoeing and hand-picking of the plants in flower. The chief objects of the trial were (1) to obtain information about the comparative costs of control (a) by spraying, and (b) by hand-hoeing; (2) to test the killing efficiency of a $1\frac{1}{2}$ per cent. solution of sodium chlorate on a large scale.

Methods.—When the first crop of witch weed came into flower the whole field was hand-hoed to remove the late crop of weeds, and the witch weed was removed at the same time. This is necessary to enable the spraying to be done economically and effectively. When the next crop of the parasite came into flower, namely, on the 10th January, 1932, the trial was commenced.

A self-filling pneumatic type knapsack spray pump with trigger release was used for the spraying, and this was worked by three natives who walked abreast, the middle one carrying the pump and doing the spraying whilst the others helped to "spot" plants of witch weed, and took turns in spraying and kept the pump supplied with solution. In this way three rows of maize were covered at a time. The spray solution was supplied to the workers in the field in 45-gallon drums, and where a number of spray pumps have to be supplied, a number of these drums could conveniently be carried on a wagon to the scene of operations.

The spraying was commenced on the 10th February and finished on the 18th. Rain interfered with the work a good deal, and falls of .44in., .70in., .40in., 1.04in., .08in. and .33in. were recorded on the 10th, 11th, 12th, 14th, 15th and 17th respectively. During the period of eight days, the pump gang actually worked 64 hours, including the midday halt for food. Therefore, the rate of work per day of 10 hours was 7.33 acres.

It is obvious that the rate of work will vary greatly with the degree of infestation by the witch weed, and for the same reason the consumption of the spray solution will vary greatly too. In this case the infestation was light, though general, and the amount of solution used per acre was just under 5 gallons; but in the case of a complete infestation, where every square yard of ground is occupied by the parasite, the consumption of solution would rise to somewhere in the

neighbourhood of 80 gallons. However, as will be explained later, at this rate of infestation spraying with sodium chlorate cannot be recommended for various reasons.

The hand cultivation carried out on field "B" was light —that is to say, the witch weed was cut off with the hoe an inch or two below the surface of the soil and collected in bags and removed from the field, since some of it was in full flower. It was commenced on the 10th February and finished on the 12th.

Results and Conclusions.—

(1) The $1\frac{1}{2}$ per cent. solution, when properly applied, gave a 100 per cent. kill, provided 2 to 4 hours of dry weather elapsed after spraying. Provided the solution has time to dry on the plant before the advent of rain, it would appear that the latter does not affect its efficiency—in fact, sodium chlorate appears to be most effective in showery weather, as has been found in New Zealand, where it has been used for killing weeds in pastures.

(2) The parasite was completely killed in five to seven days, and in no case was any growth of the sprayed weed found to occur.

(3) The work was carried out more quickly by the spraying method than by hand cultivation. The rate of work by the former method was 1.08 boy-days per acre and by the latter method 2.36 boy-days per acre.

(4) The spraying method was found to be cheaper than hand cultivation, though figures cannot be quoted owing to the loss of records of the second spraying and cultivation. Owing to the fact that witch weed cut by cultivation shoots again more strongly than the original growth from the cut stem underground, where hand cultivation is done there is usually a cumulative increase in the amount of witch weed showing above ground at each successive cultivation. When sprayed with sodium chlorate, however, the parasite is killed outright. The cost of the first spraying was rather more than that of the first cultivation, but the cost of the second spraying was about 75 per cent. of the cost of the second cultivation.

(5) No ill effects on the maize crop were noticeable, but with a heavy degree of infestation and a consequently greater

deposit of sodium chlorate per acre on the foliage of the maize and on the soil, there is danger of damage to the maize crop by poisoning.

For this reason and because of the increased cost per acre of material, the use of spraying against heavy general infestations is not recommended, and trap cropping should be carried out instead.

(6) Where the parasite was flowering at the time it was sprayed, and rain fell within 1 to 1½ hours, the flower buds which were just about to open did not open fully, although the whole plant was only partially damaged by the spray solution. In some cases the unopened flowers elongated abnormally, but did not open and seed was not "set."

(7) It was noticeable that the more mature the parasite was at the time of spraying the more rapidly was it killed by the sodium chlorate solution. This is no doubt due to the fact that the more mature plants, having more leaves and branches, presented a greater absorptive surface for the poison, and so a greater quantity entered the plant tissues.

Spraying with Other Materials.—During the past two seasons the following materials have been tested and have been discarded, either on account of the costliness of the material or its inefficiency: Sodium chloride (common salt), potassium chlorate, calcium chlorate, copper sulphate, raphanit (copper nitrate), ammonium sulphate, sodium nitrate.

Future Investigations.—Offord and d'Urbal (*Journal of Agricultural Research*, Vol. 43, No. 9) have shown that sodium chlorate is more toxic to nitella in acid than in neutral or alkaline media, and that it is likely to be most active in solutions having the same PH value as the cell sap of the plant sprayed. In this connection it is interesting to note that, with the co-operation of the Chemistry Division of this Department, the cell sap of witch weed was found to have a PH value (by the quinhydrone electrode) of 5.5, and a 1 per cent. solution of sodium chlorate was also PH 5.5. This may help to explain the great killing efficiency of such weak solutions of sodium chlorate on witch weed. Further investigation on these lines is desirable.

The "Safe" Interval between Sprayings and Cultivations.—Experiments designed to ascertain the maximum "safe" interval permissible between successive sprayings and hand cultivations of witch weed are in train and should yield results this year. This question is of great importance, as the costs of these operations on the farm are largely influenced by it. There is a considerable body of evidence showing that witch weed comes more quickly into flower after being cut at ground level by cultivation than when making normal, undisturbed growth. In the latter case, it usually takes about 21 to 23 days to flower; in the former case, it appears to flower within about 10 to 12 days. Further information on this point is required, and the writer would be glad to hear the results of others' observations on this point. At present, he is of opinion that the maximum interval between sprayings that may be considered "safe" is 4 weeks, and between cultivations 14 to 18 days—provided in the latter case that all witch weed in flower is removed from the land at each cultivation.

Trap Cropping.—There is little doubt that trap cropping is the most effective, most rapid and least expensive method of controlling witch weed. In this Colony it is particularly suitable, since the trap crop can be substituted for a green manure crop without dislocation of the system of farming and with little or no increase in costs, if the farmer grows the seed for his trap crop on the farm, as he should do.

Costs of Trapping.—If only one trap crop is ploughed under in the season, then the cost should be less than that of green manuring with Sunn hemp if white kaffir corn is used, since seed of the latter can be grown much more cheaply and the rate of sowing per acre is the same, namely, 35 to 40 lbs. per acre.

If two trap crops are ploughed under in the season, the extra cost of this practice over green manuring will be the cost of two disc harrowings, one broadcast seeding and one ploughing, less the higher cost of Sunn hemp seed.

Rapidity of Control.—With hand cultivation of the parasite or spraying, it seems certain that at least 5 or 6 years will be required to reduce the amount of witch weed to the same level as may be brought about by one year's

trap cropping (2 trap crops in one season), and it must be borne in mind that during the 5 to 6 years hand cultivation the parasite is active in reducing the yield of maize. Further, the trap cropping—at least where Sudan grass is used—is nearly as efficient as a green manuring with Sunn hemp or sunflowers, as is demonstrated by the experiments carried out at the Agricultural Experiment Station, Salisbury, during the past three years, the results of which are recorded below.

Value of the Trap Crop as a Green Manure.—In the December, 1931, issue of this journal an account is given in an article by the writer (reprinted as Bulletin No. 838) of an experiment which is being carried out at the Agricultural Experiment Station, designed to compare the green manure value of trap cropping with that of crops of Sunn hemp and sunflowers. In that article the lay-out of the experiments and the yields of the first crops of maize after the ploughing under of the various crops are given, and in the table below the results obtained in the second year are also shown, together with the averages of the two years.

The experiment was laid down in the form of a Latin square, there being four replications of each treatment and a total of sixteen plots, each plot being 1-24th of an acre.

Mean Yields per Acre of 4 Plots, in Bags of 200 lbs. each of Maize.

Crops ploughed under in 1930.	1930-31.	1931-32.	Average of 2 years.
Two successive crops of Sudan grass in the same season: 6 and 8 weeks old	16.74	15.60	16.17
One mature crop of Sunn hemp (short variety) ...	16.26	16.80	16.53
One mature crop of Sunn hemp (tall variety)	16.11	17.58	17.19
One mature crop of sunflowers	15.84	16.08	16.46

There is no significant difference between the 2-year average mean yields of maize after Sudan grass ploughed under and after either strain of Sunn hemp or sunflowers. No fer-

tiliser has been applied to these plots during the period of the experiment.

Conclusions.—It is here demonstrated that two successive trap crops of Sudan grass ploughed under in the one season, at the age of 6 weeks and 2 months respectively, are, for practical purposes, as beneficial as a green manure to the two succeeding maize crops, as are Sunn hemp or sunflowers, the two principal green manure crops of this country.

This means that the maize farmer can rapidly and cheaply reduce the infestation of his lands by witch weed, to a point where the parasite will be readily controlled by cultivation, by the use of Sudan grass as his green manure crop, and apparently without any reduction in yield from his maize crops. If he green manures his fields every three or four years with a trap crop, then within 3-4 years he can practically free them of the parasite and without any great disturbance of his normal routine.

This experiment was, of course, carried out on soil free from witch weed, and it should be obvious that had the soil been infested with witch weed, the results would have been very much in favour of Sudan grass, since approximately 75 per cent. or more of the parasite would have been destroyed by the treatment, and so the succeeding maize crops would have given a relatively heavier yield of grain.

It may appear surprising that a grass crop such as Sudan grass should have a green manurial value almost equal to Sunn hemp, and the explanation almost certainly lies in the fact that in trap cropping, the two Sudan grass crops are ploughed under in an immature state, when the fibre has not yet become woody and the nitrogen content is still high. This means that the process of rotting in the soil is rapid, and, owing to the comparatively high nitrogen content of the material, the bacteria carrying out the process find sufficient nitrogen in the grass to supply them with food, and are not forced to seek for further nitrogen from the soil, thus robbing it to the detriment of the succeeding maize crop.

Were the Sudan grass crops matured when ploughed under, it seems almost certain that the same reduction in yield of the following crop would take place, as has been found all over the world, when unrotted straw or farmyard

manure is ploughed under shortly before sowing the crop. Further, it is probable that the addition of a large quantity of carbonaceous organic matter to the soil later stimulates the activities of the nitrogen-fixing bacteria, and this leads to a considerable temporary increase in the amount of soil nitrogen available to the following maize crop.

Evidence in favour of this explanation is found in the following analyses of Sudan grass and white kaffir corn, which were made by the Chemistry Division of this Department at the time these two crops were ploughed under when they were two months old:—

Crop.	% Content of Nitrogen.	% Carbon Content.	Carbon : Nitrogen Ratio.
Sudan grass (2 months' growth)	1.89	35.28	18.6 : 1
White kaffir corn (2 months' growth) ...	1.82	34.74	19.1 : 1
Short Sunn hemp	2.52	33.00	13.1 : 1
Tall Sunn hemp	2.59	34.56	13.3 : 1

The work of Lyon, Bizzell & Wilson has shown that the minimum nitrogen content of any plant residues added to the soil necessary to ensure that the bacteria carrying out the work of decomposition shall not rob the surrounding soil of nitrogen is 1.8 per cent. As will be seen, Sudan grass and white kaffir corn were both found to contain this necessary minimum percentage.

On these facts the writer bases his belief that white kaffir corn as a combined trap and green manure crop will also be found to give results equal or almost equal to Sudan grass. An experiment to investigate this point is now in progress at the Agricultural Experiment Station, Salisbury, and preliminary results should be available at the end of this season.

Jensen's recent work at Rothamsted has shown that the rapidity of nitrification of fresh organic material in the soil is closely related to the narrowness of the carbon-nitrogen ratio of the material, and it is interesting to note, in passing, that the carbon-nitrogen ratio of the legume Sunn hemp is narrow compared with a grass crop such as Sudan, even though the latter is in an immature stage of growth. This

is a partial explanation of the greater rapidity with which legume green manure crops are found to rot down and become incorporated in our soils compared with non-legumes.

Other Trap Crops.—*White Kaffir Corn.*—The one objection to the use of Sudan grass as a trap crop is the comparatively high cost of seed, and the difficulty which has often been experienced in obtaining a good yield of seed in the wetter areas of the Colony. With white kaffir corn the same difficulty is not experienced, providing steps are taken to control stalk-borer by the use of derrisol and the depredations of birds are prevented; the crop, too, is hardier and easier to grow than Sudan grass, and seed can be purchased much more cheaply.

Warning.—The warning must be reiterated that this Department cannot guarantee that all the strains of white kaffir corn grown in this country are efficient hosts of and trap crops for witch weed, and before purchasing seed for this purpose, the farmer should re-assure himself on this point, either by testing it out himself in the field or by the experience of others.

White kaffir corn at two months' growth, when sown at the rate of 40 lbs. of seed per acre, produces approximately the same bulk of green material per acre as Sudan grass sown at the rate of 20 lbs. per acre, but it is not such a palatable or nutritious feed as the latter, either green or as silage or hay.

One important quality of white kaffir corn when grown as a trap crop for witch weed is that it serves a dual purpose, in that it is an admirable trap crop for stalk-borer of maize, and on those farms where this pest is prevalent, it should always be preferred for this reason. It is far superior to Sudan grass in this respect.

Ambercane.—A trap crop which is said to have proved very efficient in the Union of South Africa is the saccharine strain of early ambercane. This is a sorghum and closely related to Sudan grass, though having a coarser habit of growth. It is in the latter respect intermediate between kaffir corn and Sudan grass. It is an excellent fodder crop and seeds fairly freely; on the Experiment Station at Salisbury it has yielded 936 lbs. per acre of seed on an annual

rainfall of 16.8 ins., when the average yield of some half dozen varieties of maize was 1,463 lbs.

For trap cropping, a suitable rate of sowing should be approximately 25 lbs. per acre, and when sown for seed, about 10 to 12 lbs. should be sufficient, in rows 28-30 ins. apart.

A number of farmers in the Mazoe Valley, Lomagundi, Fort Victoria and Gatooma areas are testing out its seeding capacity and trap crop efficiency during the coming season, in co-operation with this Division, and their experience will be available in due course.

Native Sudan Grass (Sorghum versicolor).—This indigenous perennial grass, which is a freer seeder than Sudan grass, is under investigation as a trap crop. If it proves to be an efficient host, it may be valuable, since its perennial habit would make it unnecessary to sow a seed plot every year.

Efficiency of Trap-Cropping.—Conclusive evidence of the efficiency of trap-cropping in controlling witch weed is given in a report by Mr. George Gray, of Glendale, which was published in the June, 1932, issue of this Journal, on his experience of using Sudan grass for this purpose.

It is desired to emphasise one or two points in connection with this very successful trial. Only one crop of Sudan grass was grown on this field of 30 acres, and the stubble only was ploughed under on half the acreage, and a short aftermath on the other half. Had the whole crop been ploughed under, the resulting crop of maize would have been even better than it was. The total yield from this field was 443 bags, an average of 14.76 bags per acre.

Before the planting of the Sudan grass, the whole field was so heavily infested with witch weed that every square yard contained the parasite, and the yield of maize had been reduced on this rich soil from 15 bags per acre or more to just under two bags per acre. Subsequent to trap-cropping, the writer examined this field closely three times during the growing season, and only an occasional plant or small patch of witch weed was found every 20 to 40 yards apart on the worst infested half.

Finally, no real difficulty was experienced in ploughing under the stubble, although the weather was far from propitious at the time. A number of farmers have expressed the fear that where two trap crops are planted in one season, it may be impossible to plough under the first crop owing to wet weather until the witch weed has set seed, and so it might result in a greatly increased infestation. However, no one need apprehend such a result, for even supposing the impossibility of ploughing under the stubble on very heavy soil, the witch weed can be hand-picked once or twice as it comes into flower, until a dry spell of weather allows the ploughing to be done.

It should be remembered that when ploughing a thick grass stubble, there is not the same danger of puddling the soil as when ploughing a maize stubble or bare fallow.

Records of Growth of Witch Weed.—As a necessary basis for other investigations, observations on the rate of growth, appearance of flowers, setting of seed and allied matters were found to be necessary, and were commenced two years ago.

The following approximations were arrived at and are recorded for the benefit of those to whom they may be of interest:—

1. The period between the germination of the host (maize) and the first appearance of the parasites at ground level varied from 7 weeks to 17 weeks in red clay loam soil.

In 1932 the first parasite appeared 11 days later than in 1931, although the same stock of seed was used and other conditions were similar. All the witch weed seed was sown at the same depth, viz., 3 ins. below ground level, and the maize was sown at 2 ins. below ground level. The soil was a friable red loam.

2. The first flowers were fully out in 22 to 23 days after the appearance of the parasite at ground level.

3. The flowers fell and the seed capsules "set" two days after the flowers were fully out.

4. Approximately one flower opens fully each day on the main stem, and on each side branch, after the latter form and produce flowers.

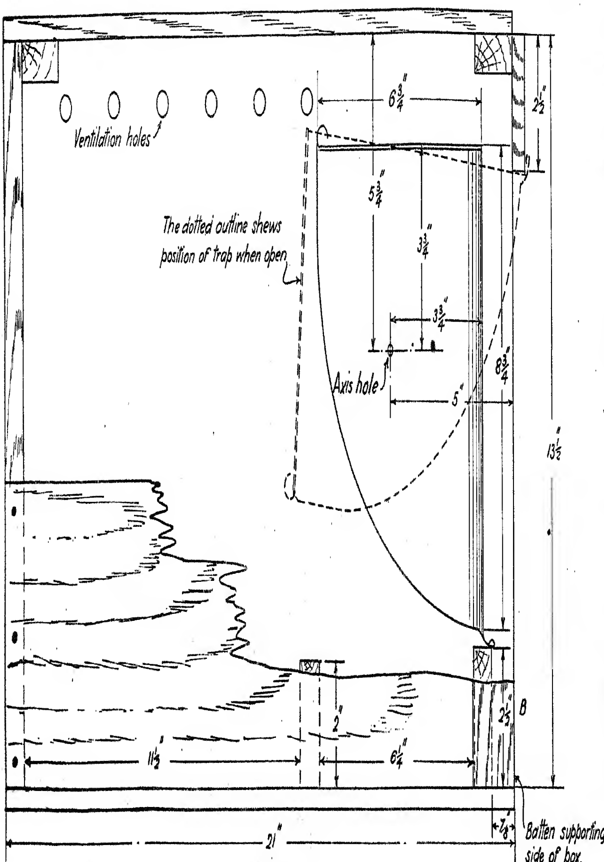
From the above it is possible, by counting one day for each flower opened fully and for each seed capsule formed on the main stem, to say approximately what period has elapsed (1) since any plant in flower appeared above ground level, (2) since it first came into flower.

Saunders has shown that the parasite ripens seed in about three weeks from the appearance of the first flower.

Check-Row Planting Maize by Machine.—The economy of hand-labour employed on witch weed eradication, which is rendered possible by the use of cultivators following check-row planting of maize, has already been stressed by the writer in previous reports, but it may be of interest to record that Admiral Aylmer successfully employed a check-row planting attachment last season on his farm at Arcturus. He planted 200 acres of maize with this implement with no difficulty and with excellent results. He was able to plant 10 to 12 acres per day without trouble.

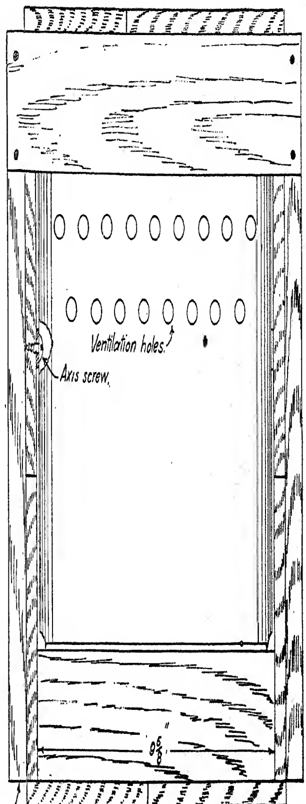
HANDBOOK OF TOBACCO DISEASES.

Attention of readers is drawn to the fact that the Department of Agriculture has found it most inconvenient, with the present shortage of staff, to handle the local sales of this book. Arrangements have therefore been made with the Rhodesian Printing and Publishing Company for distribution by them throughout Southern Rhodesia. The book may be obtained from the Herald Store, Salisbury, price 4s., or, postage paid, 4s. 4d.

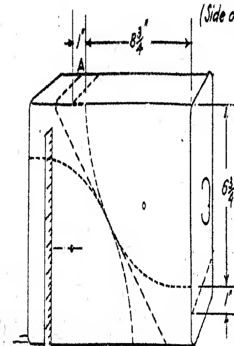


SIDE VIEW

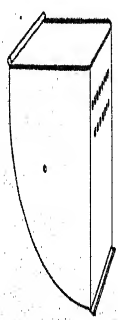
(Side of box partly cut away)



FRONT VIEW



Showing how two traps may be cut from a single tin, & method of measuring position of axis hole.



A finished trap.

TRAP NEST.

"Roller" Type, Constructed from Petrol Tin & Box.

Irrigation Division
Department of Agriculture
6.12.33 698

ANOTHER TRAP NEST.

By B. G. Gundry.

Since writing the article on trap nests which appeared in the November issue of this Journal, it occurred to the author that it might be possible to make a "roller" type trap nest from an ordinary petrol or paraffin tin and box.

Such a trap nest has since been made and has proved entirely satisfactory. The advantages which may be claimed for this pattern in comparison with the one of wood and wire netting previously described, are, that the trap itself can be more easily and quickly made. Being entirely of metal, it does not warp or twist, and for this reason is likely to remain in a serviceable condition for a much longer period. The box itself is already exactly the right size for the trap and requires a minimum amount of alteration.

The construction is shown clearly in the drawing and requires little explanation. The petrol tin should first be marked off to the dimensions shown. It is then advisable to cut it roughly into two halves with a pair of tinman's shears or large scissors, as indicated by the thick dotted line A.B. Each half can then be easily trimmed up to the proper shape, as indicated by the thinner dotted lines. The exact shape of the curved sides of the trap is not important and can be judged by the eye; but if a number of traps are to be made, it is as well to cut out a pattern in cardboard or tin from which they can all be marked off.

It is important that the axis holes about which the trap revolves should be exactly opposite each other. As the corners of the tin are rounded, it is advisable when determining the position of these holes relative to the rounded corners to measure the distance of three and three-quarter inches vertically from some level surface on which the tin can be held firmly, resting on its side as shown in the bottom

left-hand corner of the drawing. A few holes may be punched in the front of the trap to provide ventilation, but this is not absolutely necessary, as the box itself is well ventilated.

One end of the box must be entirely removed and sawn into strips to form the necessary battens, etc. Two strips about one and a half inches wide will be required to hold the sides of the box together, and are nailed in an upright position on either side of the front opening.

A strip two and a half inches wide placed just inside this opening, on which the trap closes, will serve to hold the bottom and sides together, so also will a cill two inches deep placed inside the box eleven and a half inhces from the far end to form the front edge of the nest. Another strip must be placed across the top of the front opening to hold the trap when in the open position, and a couple of battens should be nailed across the underside of the lid to strengthen it.

Ample ventilation should be provided by boring a number of holes not less than half an inch in diameter high up in the sides of the box.

The trap may be hung by two small wood screws or bolts with an ordinary roofing washer placed between the trap and the side of the box. The position of the screw holes in the sides of the box should be determined by careful measurement, so that the trap will work smoothly.

A trap nest of this description will serve for the smaller breeds, but for the heavier breeds it will be necessary to arrange the trap in a larger nest box.

NOTES ON AFRICAN ALOES.

By H. Basil Christian, "Ewanrigg," Arcturus.

PART V.

Aloe speciosa lives up to its name as "the beautiful aloe. It is one of the tall-stemmed aloes attaining a height of up to twenty feet, often being forked near the apex.

It occurs in the Grahamstown and Alicedale districts of the Eastern Province of the Cape.

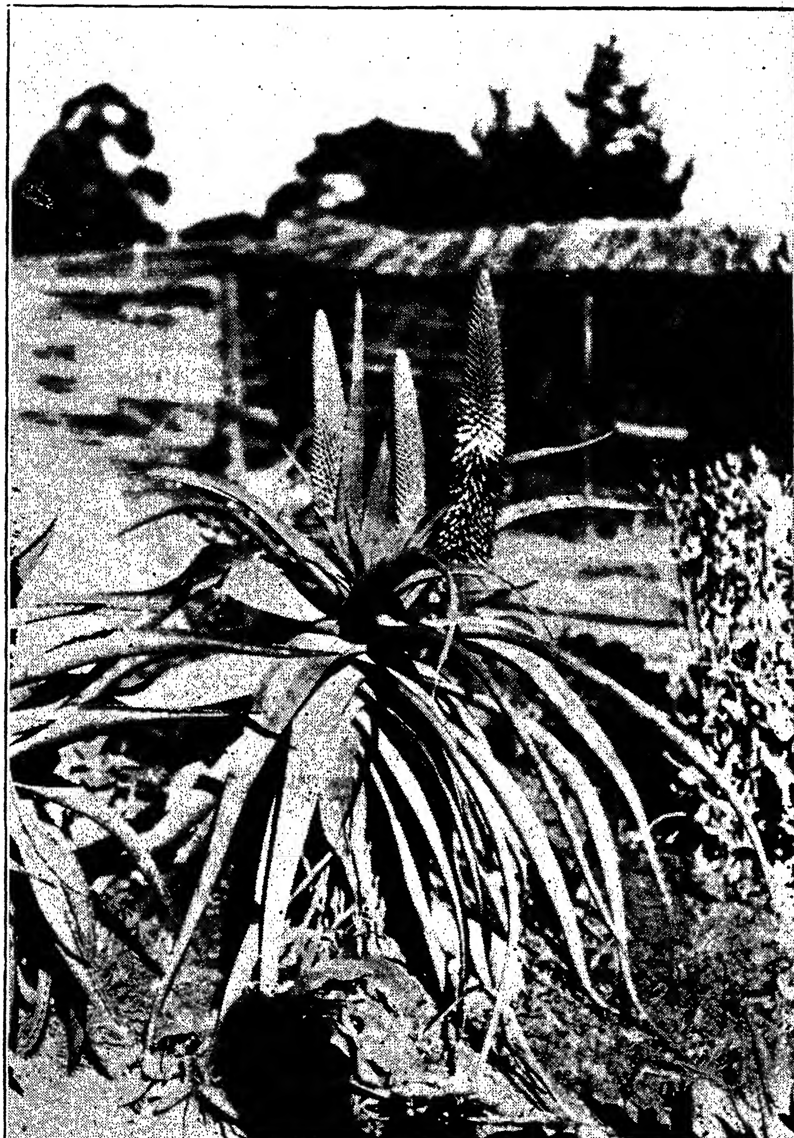
The leaves are in a dense rosette and are long, soft and fleshy. They are of a glaucous hue, smooth on both faces and bounded on the edges by a thin pink margin, on which there are minute teeth rather far apart.

The inflorescence consists of one or more stout unbranched spikes. The racemes are densely flowered, the buds being of a rich rose-pink colour, but as they mature they turn to a creamy white to pale green. When the flowers open, the stamens, which are dark in colour, become exserted, giving the effect shown in the illustration of three distinct colours, one below the other.

For a long time this aloe was confused with one named *Aloe spicata* by the earlier botanists, but in recent years Dr. Marloth proved that the two aloes were synonymous, and now the name "*spicata*" has been dropped.

It is rather slow growing, but once it reaches flowering size it flowers regularly in Southern Rhodesia in July and August.

Aloe striata is one of the best known aloes of the Cape, where it is called the "coral aloe." It is one of the most easily recognisable aloes on account of its very pale grey glaucous leaves with a pink margin, and by the fact that it has no spines either on the margins or surfaces. It is,



A. speciosa.

A. striata.

A. africana.

in fact, one of the two or three known species that have no spines on the margins.

It is an acaulescent plant, often assuming a semi-decumbent position. The leaves are broad in proportion to their length, very pale grey glaucous with pink margins and very faintly lined. The inflorescence is much branched, often two or more from the same rosette of leaves. The peduncle is 18 inches to 24 inches high, above which it is branched. The racemes are short, 3 inches to 4 inches long, and lax. The flowers are more or less pendulous, of a pale coral red colour. The stamens are included or only slightly exserted.

It flowers freely under Southern Rhodesian conditions, and different plants flower off and on from May until September.

It is confined to the Cape Province and Namaqualand, nowhere extending beyond the Karroo.

It has been largely used by gardeners for hybridising purposes.

Aloe africana is one of the tall-stemmed aloes, reaching to a height of eight to twelve feet, sometimes more. It was one of the first of the aloes to be sent from the Cape to Europe by the Governor, Adrian van der Stel, in A.D. 1701.

It occurs in countless thousands in the Zwartkops River valley near Port Elizabeth and along the coast between there and Port Alfred.

At the old mission station at Bethelsdorp in the Zwartkops River valley, the coloured people plant this aloe and *Aloe ferox* close together along the boundaries of their holdings, where they provide impenetrable fences or hedges, with the added advantage that they do not spread, as is the case with the prickly pear.

The leaves of *Aloe africana* are spreading and often gracefully recurved towards the apex, about 2 ft. 6 ins. or more long and about 4 inches broad at the base. They are green and strongly toothed along the margins, with a few scattered teeth on the upper third of the under surface, and have two to three teeth on the upper surface.

The inflorescence is simple or branched. The raceme is densely flowered and about twelve feet long. The flowers

are deflexed but upturned near the apex, this being one of its most striking features. The stamens and style are exserted (project beyond the perianth). The colour varies from orange to crimson, in all cases becoming lemon chrome colour as the flowers mature.

Under Southern Rhodesia conditions it has two flowering seasons — April and May, and again in August and September.

SALES.

AGRICULTURAL EXPERIMENT STATION, SALISBURY.

Spineless Cactus Slabs (blades) Algerian variety, per 100 slabs, 7/6 Salisbury, or 12/6 delivered free by rail to purchaser's nearest station or siding in Southern Rhodesia. For amounts of 500 slabs or more a reduction of 2/6 per 100 will be made.

Stocks are limited and delivery cannot be undertaken after 15th November.

Kudzu Vine Crowns, per 100 crowns, 15/-, Salisbury, or 25 crowns, 7/6; 50 crowns, 15/- and 100 crowns, 22/6, delivered free to purchaser's nearest station or siding in Southern Rhodesia. Delivery during September and October for irrigated land, and in January for dry land. Owing to pressure of other operations, it is not possible to deliver Kudzu crowns during November and December.

Woolley Finger Grass: 10s. per bag of roots, delivered on rail nearest station or siding; supplies limited. Available January and February.

The prices quoted above do not include charges for road motor transport. Cheques should be made payable to the Department of Agriculture, and preliminary enquiries and subsequent orders should be addressed to the Chief, Division of Plant Industry, Department of Agriculture, Salisbury.

TREE PLANTING.

Issued by the Division of Forestry.

In the planting of young trees it is most important that great care be exercised. Careless planting can be accountable for a large percentage of losses in a plantation, and expenditure incurred in careful planting is money well spent.

Planting Distance.—It has been found in this Colony that a planting distance of 6 feet by 6 feet is the most economical and serviceable. This espacement ensures, under normal conditions, the formation of canopy at an early age in the life of the wood. It prevents the formation of heavily branched trees, the timber of which would not be of first quality, and it gives a reasonable margin in allowing for failures and still having a well-stocked stand of established trees. Some slow-growing trees, or trees which have a pyramidal habit of growth, may even be planted 5 feet by 5 feet. Good examples of these trees are the *Callitris calcarata* and *C. robusta*, which, in the tree-veld zones, do not ordinarily form canopy until the fifth year from planting.

The approximate number of plants required per acre may be estimated by dividing the number of square feet in an acre by the square of the planting distance. In the case of rectangular but not square planting, the number required is obtained by dividing the number of square feet in an acre by the product of the distance in the rows and the distance between the rows. Thus, the number of plants per acre in a 6 feet by 6 feet plantation would be—

$$\frac{43{,}560}{6 \times 6} = 1{,}210 \text{ plants}$$

and in a 5 feet by 6 feet plantation—

$$\frac{43{,}560}{5 \times 6} = 1{,}452 \text{ plants.}$$

Period for Planting.—In theory, planting may be carried out at any time of the year. In practice, however, the planting period in this Colony is confined to the rainy season. The hard experience of many disappointments has shown that in the tree-veld zones—i.e., the regions west of the high eastern border—planting should be left over to the latter half of the rainy season, for two main reasons, viz.:—

(i.) The rains in October, November and December are often extremely unreliable, and are generally characterised by thunderstorms and short heavy downpours. Following on the long dry season, the soil is usually so baked that intense evaporation and run-off allow very little moisture to soak into the ground. In consequence, trees planted during favourable weather in these three months have only surface water upon which to draw. This encourages a surface root system. The intra-seasonal droughts, which are common, effect an almost complete drying out of the surface layers of soil, with the result that the young plants are caught high and dry, and if they do not actually succumb, they are so weakened that they fall an easy prey to disease and that ubiquitous scavenger, the termite or "white ant."

As a contrast with this, the rains of January, February and March have a steadier and more persistent fall. The cloudy weather retards evaporation, and run-off is appreciably lessened, with the result that conditions favour the soaking of water into the soil and sub-soil. Young trees planted in such soil have therefore every inducement to develop a strong taproot. When the rains cease and the water table sinks, there is no longer mere inducement to the roots, but actual stern compulsion to follow the sinking water table if life is to be maintained.

(ii.) During the first half of the rainy season the growth of grass and various weeds is particularly vigorous, and unless this is kept in check, often at great expense, the competition with which young trees are called upon to contend is severe and exacting. By the end of January, however, the weed growth has relaxed considerably in vigour, with the result that more food and moisture become available to the recently set out plants.

A consideration of the foregoing will show that planting over the larger portions of the Colony should be confined to

the latter part of January to February and March, and even in years of good rainfall, early April.

Planting Weather.—Planting is most successfully carried out on dull, windless and drizzly days, and preferably in late afternoon. Sun and wind produce a less humid atmosphere, which necessitates the exercise of more than ordinary caution in limiting the exposure of the roots of plants to the shortest possible time.

Size and Shape of Plants.—In ordinary forest practice in this Colony, plants should be set out when they are 3 to 6 inches high. The root system should be well balanced in relation to the rest of the plant, and should be well supplied with small fibrous roots. Taproots of undue length should be nipped off to a reasonable length as well as abnormally developed lateral roots (*vide* figs. 2A and 2B). Plants with badly bent taproots (usually the result of bad pricking out) should be thrown away, as sooner or later they will fail in the field.

The smaller the plant set out—say down to 3 inches—the greater are the chances of success, in that there is a smaller root system to disturb and less shock from which to recover when the roots are struggling to establish themselves in their new environment.

If often happens, when favourable planting weather is long delayed, that eucalypts and other fast-growing, broad-leaved trees have reached an alarming size by the time planting is possible. In such cases it is usually advisable to cut back the plants to leave about 6 inches of stem, which may have a few or no leaves remaining. Immediately before actual planting, the root systems should be correspondingly shortened.

When suckers, e.g., of poplar or bamboo, are set out, the same operation of cutting back should previously be carried out.

Planting Methods.—

(a) *With Balls of Earth.*—The most common practice in this Colony is to use plants which have previously been pricked out into tins or trays, usually 25 to 30 in a tin.

At the planting site a hole is made with a hoe, spade or trowel, slightly deeper than the length of the root system of the plant. The plant is removed from the tin or sack and placed well into the hole. Earth is placed on the bottom of the root, and the plant is then gradually drawn up until the collar is on the level with the top of the hole.

During this operation, which ensures the straightening out of the roots and the natural spreading of the whole system, earth is tamped round the roots until the hole is filled. If care is taken to start tamping at the bottom of the hole, there need be no fear of leaving air spaces to which the roots might be exposed. The soil is firmed and watered as in the method for balled plants.

A quicker method of planting is with the dibbling stick, which is pointed and of square, triangular or circular section. The soil is pierced with the stick and the plant inserted into the resulting hole in such a manner that the taproot is not bent. While the plant is being held in position, the stick is pierced obliquely into the soil a few inches from the first hole. By applying pressure to bring the stick into a vertical position, soil is pressed against the plant and the operation is complete. The disadvantage of this method is that there is no certainty that no air spaces are left at the bottom of the first hole. Many failures are accounted for in this way, especially when raw labour gangs are used in planting operations.

Various methods of planting by "notching" are sometimes used, especially in soils whose texture will allow of a clean cut. "T-notching" is the most common, and is carried out by means of a spade. The spade is inserted into the soil to a depth commensurate with the length of the root of the plant. At one end of the notch or slit so formed the spade is again inserted at right angles. The spade is then tilted back, with the result that the first notch opens out. The plant is then placed in the gap and the spade withdrawn. The earth will tend to subside into its original position, but assistance should be given by pressure of the feet to ensure that no air spaces are left.

In the tree-veld zones the dibbling and notching methods are not advocated. Skill and understanding are needed in carrying out the operations. In any case, the roots assume

an unnatural position in the soil, and in a country where tree planting is fraught with numerous pitfalls, any method which is inimical to the formation of a normal root system should be avoided.

All methods of setting out open-rooted plants are subject to appreciable failures, namely, by reason of the fact that roots are more liable to exposure to the air than when balled plants are used. Unless, therefore, keen supervision of planting is exercised, it may well be that the initial low cost of such operations will, by reason of repeated subsequent filling of blanks, eventually equal the expense which would have been incurred by planting with balls of earth.

CURING TOBACCO BY ELECTRICITY.

AN OUTLINE OF THE EXPERIMENTAL WORK.

[*The following is part of the final report issued by the State Electricity Commission of Victoria during July,* 1932. *It contains such a wide range of information that we are certain its publication in this Journal will be appreciated by all tobacco growers. Our acknowledgement to the State Commission appears in the Editorial of this issue.*—Ed.]

The conclusions reached as the outcome of the initial tests conducted last season in the experimental electric kiln were set out in the first report as follow:—

That by the use of electricity for the kiln curing of tobacco:—

1. The fire risk is reduced to the minimum.
2. The possibility of taint from flue gases is eliminated.
3. The aroma of the electrically dried leaf is noticeably stronger.
4. The drying can be speeded up without the use of excessive temperatures.

5. The minimum of attention is needed.
6. "Sponging back" can be eliminated.
7. The colour is brighter.
8. The grade is more uniform.

The claims were, of course, of a general nature, and it was felt that information of a more precise character was desirable. Further, a series of questions in respect to the technique of the kiln curing process arose during the previous tests about which no unanimity of opinion could be obtained. The methods now in vogue in flue curing are obviously empirical, and it is noticeable that in regard to most of the questions which are set out hereunder, little experimental work has been reported in Australia.

(a) What is the optimum curing temperature, and to what extent, if any, is it dependent on the comparative ripeness of leaf and climatic conditions?

(b) What is the optimum humidity for curing, and to what extent, if any, is it dependent on ripeness or other factors?

(c) Is ventilation necessary during the curing process?

(d) Under what conditions of temperature and humidity can the colour best be fixed?

(e) What are the limiting conditions as regards temperature during drying operations?

The experimental work was somewhat hampered by the fact that the objectives were to a certain extent divergent. On the one hand, it was the natural wish of those in charge of the experiments to accomplish better curing and so demonstrate the advantages of the electrical method. On the other hand, it was necessary from time to time to vary the technique of the curing and drying process in order to ascertain the effect of such departures from normal operating conditions. In this way quality was sacrificed in several batches of leaf—an unavoidable result of the experimental method.

To avoid as far as possible the waste of leaf occasioned by large scale experiments, and to secure more critical control of environmental conditions, some of the experiments

were carried out on a laboratory scale. These, while not so conclusive as kiln tests, were very valuable in checking up theoretical assumptions of the bio-chemical reactions of the leaf during the curing process. On the matter of its connection with the thermal economy of curing, there is little, if any, published information, and no apology will, therefore, be necessary if a section of this report is devoted to other than purely thermal and electrical considerations.

The Effect of Temperature in the Curing Process.—The temperatures recommended by different authorities for curing vary over rather wide limits. As low as 70° F. and as high as 105° F. have been actually adopted with success. On the face of it there is no reason why any temperature ordinarily consistent with normal atmospheric conditions during summer should not be entirely suitable for colouring the leaf. In practice it is found that any temperatures within the above stated limits may give satisfactory results. It is not, however, sufficient to get good results—it is essential to get those good results economically. Artificial heating costs money, and the greatest use has to be made of the plant capacity necessary for processing the leaf. What effect then has temperature on the thermal efficiency of the curing process?

To answer this question a series of small scale experiments was conducted to determine the relative rate of colouring at different temperatures. The method adopted was to suspend leaf in glass jars immersed in water baths held at pre-determined constant temperature by electrical thermostats. So that no other factor but temperature could influence the results, the leaf used was split down the midrib, and the respective half leaves were treated concurrently at the different temperatures. Humidity was maintained absolutely uniform at just below saturation. The results are set out in Table 1, which gives the average of a number of tests and for rather late leaf picked towards the end of April. It is not certain that the temperature-time ratio would hold good for earlier or later leaf or for all varieties. The results, however, indicate that colouring is not only accelerated at higher temperatures, but also that the rate of acceleration per degree temperature rise is definitely greater at higher thermometer levels.

TABLE 1.

Apparent Effect of Temperatures on Rate of Colouring.

Class of leaf.	Time taken in hours to attain "standard" colour at temperatures shown Fah. 75°	80°	85°	90°	95°	100°
Thoroughly ripe, leaf slightly colouring ...	27.5	26.5	25.0	22.5	19.5	16
Thoroughly ripe, leaf not colouring	40	35	—	31	—	24
Leaf of doubtful ripeness	—	52	—	48	—	40

Applying these results and limiting ourselves for the moment to questions of thermal efficiency, it may be asked which temperature—90° or 80°—for instance, is the most economical to adopt. For ripe and slightly coloured leaf, the use of the lower of these temperatures increases the time required to reach "standard" colour by 17½ per cent., and for ripe but uncoloured leaf by 13 per cent. The average atmospheric temperature during the tests was 65° F., and the radiation losses per hour through the kiln walls were thus increased by 60 per cent. at the higher temperature. The net effect of the adoption of 90° as opposed to 80° for curing is, therefore, that about 40 per cent. more fuel or electricity will be required after allowing for the shorter time and for the average run of ripe leaf. The practical outcome of these results is that curing conditions, if economy is a consideration, should be varied according to the heating method adopted. For electrical operation where energy is an item of cost, and labour and attention costs are negligible, comparatively low temperature should be adopted. For the fuel heated kiln, where wood fuel is cheap, and labour is the principal item of cost, the higher temperatures may be more economical.

The foregoing observations are, of course, subject to variation according to seasonal conditions. The practice of curing at a higher temperature in the earlier (and warmer) part of the season, gradually reducing that temperature toward the cooler part of the harvesting season, has a perfectly sound basis, and the advantage of comparatively low temperature curing for leaf of non-uniform ripeness was demonstrated

both in the kiln and in small scale experiments. The general conclusion, however, arrived at as a result of all the tests was that, except from an economic standpoint, temperature is not an important factor in successful curing, but that fluctuations of temperature during the colouring period are definitely detrimental. Smudging of the leaf toward the completion of colouring can be produced by reducing the temperature only five degrees in a saturated atmosphere. It appears that the precipitation of cool moisture on the leaf surface is a contributory cause of smudging, and it is in the avoidance of this trouble arising from temperature variation that thermostatically controlled electric heating has very definite advantages.

The Presence of Atmospheric Moisture in Relation to the Curing Process.—A practically saturated atmosphere is generally aimed at as one of the essentials of the curing process. It is undeniable that so long as the temperature is maintained sufficiently uniform, excellent curing does result from the application of such conditions. On the other hand, experience in the electric kiln and in small scale experiments has shown that much lower percentages of humidity, particularly at low temperatures, are equally effective in developing colour in the ripe leaf. It may be shown experimentally that under comparatively dry air conditions a leaf will colour almost perfectly if it is fed with moisture by the immersion of its stem in water. It seems, therefore, that all that is necessary is to provide such environmental conditions that the sap cells in the leaf will not collapse, and this is secured by enveloping the leaf in an atmosphere upwards of 75 per cent. saturated according to temperature. It may be mentioned that relative humidity does not measure the evaporating power of the air, but that approximately equal evaporative power is obtained if between 75° and 95° F. the humidity roughly follows in percentage that of the temperature in degrees.

In a completely saturated atmosphere there must be precipitation of moisture if the temperature falls only one degree. Condensation of moisture on the leaf, particularly toward the completion of curing, is one of the conditions most to be avoided, and thus it is safer to maintain humidities hardly exceeding 90 per cent. for a temperature of 90° if smudging

is to be avoided. Another disadvantage of the maintenance of full saturation lies in the difficulty of removing the moisture when curing is completed and drying must commence. The practice that appears to give the best results is to commence curing in a well saturated atmosphere, allowing the humidity to diminish slightly toward the end of the colouring process. The ordinary kiln is, however, seldom air-tight and high humidity is frequently difficult to maintain; in fact, it is usual to spray water on the floors or to spread wet bags over the flues to secure the requisite degree of humidity. Even in the insulated electric kiln it was found that there was sufficient air leakage to make it necessary to maintain humidity by supplementary means, and the method adopted may be described as it affords a further instance of the remarkable facility with which electricity can be utilised in automatic regulation.

An ordinary indicating hygrometer was modified by the introduction of electrical contacts, so that when the humidity fell to a pre-determined percentage, a circuit was completed which, operating through a relay and a magnetically controlled valve, allowed water to drip on to a protected heating element. Steam was thus generated in sufficient quantity to make up any deficiencies in humidity caused by opening doors or the requirements of increasing temperatures. A hygrograph record shows practically straight line regulation of the atmospheric moisture content under this system of control.

The Necessity for Ventilation during the Curing Process.—During the tests of the electric kiln early in the season some difficulty was experienced in maintaining sufficient moisture in the internal air during curing. The cause was traced to leaks in the ducts and other parts of the kiln, which, after being made air-tight, reduced the moisture loss to manageable dimensions. Contrary to expectations, however, the new conditions did not facilitate the curing, but resulted in a greatly reduced rate of colouring and an almost complete absence of bright leaf. It was not until three kilns had been put through with increasingly disappointing results that any explanation of the reason was forthcoming. It was then thought probable that the trouble might be somewhat akin to that of "brown heart" in apples under

storage conditions. Accordingly, ventilation was introduced with immediate and beneficial results to the colouring of the leaf.

The phenomena naturally led to further investigation of the factors influencing curing. Experiments had proved that neither temperature nor humidity were critical factors, and observations of the equal results obtained in various kilns under widely different conditions indicated that there was some factor of greater importance than either of those which, in the past, have been regarded as all important. It seemed that in the chemical characteristics of the kiln atmosphere rather than in its temperature or moisture content the controlling factor was to be found.

It should be remembered that curing is a maturing process in a still living leaf involving a succession of physiological processes which require the inspiration of oxygen and the expiration of carbon dioxide and other gases. In an enclosed space the expired gases must accumulate unless, as in the case of indifferently constructed kilns, there exists a sufficient and constant leakage of air to carry off the excess. In the electric kiln, as previously mentioned, steps had been taken to attain comparative air-tightness, and it was not surprising that a simple analysis of the internal air toward the end of the curing period disclosed up to 7 per cent. of CO_2. No quantitative data being readily obtainable on this phase of the curing problem, it was decided to determine roughly what was the respiration rate and what was the consequential ventilation requirement. The results of the small scale experiments are shown in Table 2, and it should be noted in connection therewith that only a rough approximation was obtainable under what amounted to "field" conditions.

The determination was made by suspending a quantity of leaf in closed glass jars immersed in water baths at 95 degrees F. Sufficient air, pre-heated and at roughly 80 per cent. saturation, was passed through the jars to maintain the CO_2 dilution at the percentages shown in column 1. The extruded air was passed through caustic potash solution and the diminution of volume measured. The fact that about 2 per cent. of CO_2 is the highest that is permissible without appreciably retarding the ripening and colouring process

was further indicated by the production of only 382 c.c's. per lb. at a dilution of 0.5 per cent. of CO_2 in pure oxygen.

TABLE 2.

Production of CO_2 by Ripe Tobacco Leaf about 50% Coloured towards the end of Curing Process under Various Concentrations of Self-exhaled CO_2.

Average concentration CO_2 %	Production of CO_2 per lb. of leaf per hour. Cub. centimetres.	Cubic feet of CO_2 per ton per hour.	Equivalent to requirement of air per ton of leaf per hour. Cub. feet.
1.9	366	29	138
2.0	345	27.3	130
3.0	290	22.9	110
3.9	142	11.2	53

The data as first evolved was considered in the light of the figures given in columns 1, 2 and 3, but later it was thought that the retardation of respiration might not be due so much to excess of CO_2 as restriction of oxygen, and this assumption was given some support by the perfect coloration of leaf in an atmosphere containing 50 per cent. of added CO_2, but otherwise well supplied with oxygen. Column 4 was therefore added as a more reasonable interpretation of ventilation requirements. The practical outcome of a study of the figures is that in a large kiln containing 600-700 sticks of leaf a supply of air gradually increasing to roughly 400 cubic feet per hour toward the end of the curing process should be available either by leakage or intent. It was one of the advantages of the electric kiln that either an occasional scavenging of the internal air or a continuous admixture of fresh air could be introduced through the pre-heater of the fan circulating system without any variation in temperature and only a momentary drop in humidity.

Artificial Aids to Colouring.—The green pigments of plants are called chlorophyll. They are necessary in the leaf for the formation of sugars, since chlorophyll is the pigment and makes possible the assimilation of the carbon dioxide of the air. If the tobacco leaves are light in colour and lack chlorophyll, it is difficult for the plant to form the sugars, starch, proteins, etc., which are necessary for healthy growth. The pale green types of tobacco show this

deficiency. They are not as vigorous growers as the greener varieties. Dark green plants in the seedling beds and in the field show a markedly more rapid growth than their neighbours. These dark green plants are evidently more rapid growers, because they have more chlorophyll and can make more sugars, and although high sugar content is highly desirable, dark colour is not. The grower is faced with the difficulty that he can seldom combine very bright colour with heavy yield of crop.

The query naturally arises: can any special treatment be applied whereby the colour of heavy bodied and aromatic leaf be improved? There is some encouragement for such an aim when it is remembered that the artificial colouring of certain vegetables and fruits is practised commercially. It was discovered some years ago that minute applications of certain gases had an effect on the chlorophyll, causing it to disappear in favour of the colour of ripeness. Oranges, lemons, tomatoes and bananas will turn from green to ripe colour if subject to extremely weak applications of coal gas, acetylene or ethylene for a few days. The action is purely catalytic; there is no bleaching in the manner that sulphur fumes are used to colour apricots for drying. The gases which are used at concentrations not greater than one in ten thousand merely set into rapid action the normal mechanism which brings about the decomposition of the green pigment leaving the yellow unaffected.

Experiments were conducted to determine whether the dark green varieties of tobacco would respond to treatment of this character. Unfortunately, the initial tests gave only negative results, though it must be admitted that the conditions under which they were carried out reduced the probability of success. At the time of the kiln test it had not been discovered that ventilation was deficient and the curing was suffering from oxygen starvation. It has been realised since that the metabolism of the leaf must be normal if its response to the gas treatment is to be expected. Further, it is thought probable that the average period of curing—up to 48 hours—is insufficient for effective action, as, in the case of ethylene, a period of from three to eight days is necessary for blanching celery and colouring tomatoes. Had the curing period been extended by the use

of low temperatures the leaf could then be subjected to the action of the ethylene for perhaps four days, and very different results might have been obtained. It may be mentioned that ethylene (C_2E_4) is, in concentrated form, a sweet smelling gas readily obtainable commercially. In the proportion of one in ten thousand used for treatment, its smell cannot be detected, and consequently the aroma of the leaf is unlikely to be affected. It seems to be desirable that the possibilities of the idea should be further investigated.

The Technique of the Curing and Drying Process.—A great deal of information of a character that might be termed "working instructions" has been published to aid the grower in the operation of flue kilns. Simple time and temperature tables have enabled many inexperienced growers to obtain satisfactory results. An expression of the fundamental principles involved has not, however, so far as can be traced, been published in Australia, and a simple statement of those principles as evolved from the experimental work may be attempted.

It is conceded that if any particular method develops into a general practice, there must be some sound reason for its adoption. Expediency does, however, enter into the technique of most processes, and an examination of the popular method of curing and drying tobacco leads one to the conclusion that it is no exception in this respect. Almost all growers have had the experience of bad curing when, according to general practice, their method has been faultless. Almost all growers state quite frankly that there is a great deal of luck in getting perfect results. The question arises, therefore, whether a better understanding of the principles rather than the practice of curing would not enable some of the elements of chance to be eliminated.

The work conducted in the electric kiln was not expected to solve all the technical problems connected with curing, but it did reveal the large number of problems upon which careful research should in the grower's interest be carried out. As far as the work went, however, certain conclusions were arrived at which, in their recording, may prove informatory to growers.

The processing of tobacco may be considered separately under three main headings:—

(a) The colouring.

(b) The fixation of the colour.

(c) The drying.

Set out below are what are believed to be the fundamental requirements of each stage of the process:—

(a) Good colouring is dependent upon—

(i.) the leaf being thoroughly ripe, unbruised, clean and not too closely packed when placed in the kiln;

(ii.) the maintenance of such moisture in the atmosphere that the sap cells dot not collapse, due to loss of moisture by evaporation;

(iii.) an ample supply of air for respiration;

(iv.) a temperature which is normal to ripening —that is, which approximates summer atmospheric conditions.

(b) The fixation of colour requires—

(i.) the withdrawal of moisture from the web of the leaf with sufficient speed to arrest the life process and to prevent the thicker portions from over-ripening.

(c) And the drying of the leaf simply requires—

(i.) the complete dehydration of the leaf at the lowest economical temperature.

Considered in the light of the above-mentioned requirements, the curing and drying of tobacco is simplicity itself; it is only the application of heat which complicates the process.

It is probable that the conditions formulated above as essential for good colouring will not be questioned. On the other hand, it may be a matter of surprise to many growers that increasing temperatures are not essential for either fixing the colour or for drying. The experiments most conclusively demonstrated that better colour can be obtained without applied heat than with it.

If the temperature in the kiln at the completion of colouring is, say, 90 degrees, and it is maintained at no higher than that temperature after the fans are started, and the whole of the moisture laden air is removed and continually replaced with fresh, dry air at 90 degrees, excellent fixation of colour results. Drying is, of course, extremely slow, and other factors render low temperatures more costly in time and heat than the recognised method, but technically it is superior.

To determine whether a sudden withdrawal of moisture unaccompanied by heat is detrimental, some well-coloured leaf at the completion of curing and while still full of moisture was transferred to a container which was held at a vacuum of 15 in. and at the same temperature to which the leaf had been subjected during curing. Drying was not fast—it took some 24 hours before the web was dry—but even that rate was much faster than air drying. There was absolutely no smudging, and the colour was better than that of the corresponding leaf dried with heat. It is obvious, therefore, that the commonly held opinion "that a sudden removal of moisture causes the sap cells to collapse and discolour" is wrong. Sudden rise in temperature will invariably produce that effect, but withdrawal of moisture alone will not do so.

Interesting as these speculations are, they do not obviate the difficulty that heat is at present the only practicable method of drying tobacco in kilns. The ordinary kiln requires heat not only to liberate the sap in the leaf, but to induce air currents within the kiln, which in turn carry off the vapour. In the electric kiln, fan circulated currents of air provide a more certain vehicle for carrying off the moisture, but heat is still essential for facilitating evaporation from the sap cells of the leaf in order to obtain proper drying. Experience with the electric kiln proved the great advantage of forced air circulation, separate heating chambers, and pre-heaters. In fixing the colour, for instance, it was a simple matter to pass large quantities of dry air through the kiln without raising the temperature—a feature which is impossible in flue heated kilns. For drying, however, low temperatures are not economical; the total consumption of fuel or electricity must be increased if less than the maximum temperature that the product will stand is used. It is more

economical to dry at 200 degrees F. than at 150 degrees F.—but can the leaf withstand the higher temperature without loss of quality?

It is known that volatilisation of nicotine occurs if the leaf is subjected to excessive temperature, but that condition is advantageous. It is probable, however, that some of the essential oils which are responsible for the aroma might also be volatilised; and this condition must be avoided. Further, the pigments are susceptible to the higher temperatures, and that darkening of the colour occurs in a marked degree at certain temperatures was demonstrated by the following experiments.

Partially dried leaf of bright lemon colour was removed from the kiln and subjected to dry air at various temperatures until thoroughly dry. Table 3 gives the respective time occupied and the effect on the colour.

TABLE 3.

Drying Temperature: degrees F.	Time Occupied: hours.	Final Colour Comparison.
150	22	Bright lemon.
170	15	Same colour.
190	10	Very slightly deeper colour, rather orange.
210	6	Visibly affected in colour in two hours. Mahogany colour in six hours.

It appears, therefore, that to retain the brighest colour the kiln temperature should not exceed about 180 degrees F., unless for a very limited period. Not only the colour, but the aroma was noticeably affected in the sample held for as short a period as one hour at 210 degrees F. A slightly scorched smell resulted, not unpleasant, but probably somewhat detrimental to selling value judged from present standards of quality.

FARMING CALENDAR.

January.

BEE-KEEPING.

This month is a slack one for actual hive work. Each hive should continue to be carefully watched to see that any attempt by the wax moth to gain a footing is at once stopped. In the great heat of this month, see that proper ventilation is supplied, as well as enough water. Precautions against the depredations of white and other ants should also be watched daily. Where possible, examine now and again the brood chamber for queen cells, and destroy them if not wanted. Requeening can be done where desired on the uniting system, if the apiarist does not know of the better plan of rearing his own queens. In the workshop have a spare hive or two complete and ready for occupation, well painted, for any new swarms that may be required in the coming months. Though the second honey flow of the season is not due to start until about March or April, there should be ample stores coming in meanwhile to keep all bees busy in breeding, nursing, and bringing the hive generally to full strength for the winter, as well as for their own daily food supplies. There will not be enough honey coming in now for surplus purposes, therefore see that the supers are not left on the hives to a greater degree than to give the inmates plenty of room to loaf in.

CITRUS FRUITS.

The planting of citrus trees should be completed if possible by the end of the month, for trees planted later may not harden up before the winter; they then become susceptible to winter injury from cold. This month is the best one for planting shelter belts to protect all varieties of fruit trees from the prevailing dry winds. Cover or green crops may be planted during this month; if the grove has been over-run with grass or weeds, sow the cover crop seed more thickly. This will assist in smothering future weed growth. Continue suppressing any undesirable shoots that may develop on the tree trunk or other parts of the tree. Drain any depressions that allow rain or irrigation water to accumulate at the base of the trees, for trees permitted to stand in water will speedily fall victims to disease or pest injury.

DECIDUOUS FRUITS.

Continue planting cover or green crops between the trees. These crops may then be turned under towards the end of the rainy season to furnish the necessary humus.

Summer pruning may be continued. Rub or break off any undesirable shoots that have a tendency to crowd each other; suppress all growths on the main stem from the ground level up to the main arms of the tree, for these are unnecessary. If next year's fruit crop is to be of good size and quality, the inner fruiting wood of a tree must receive sufficient air and light to mature fully. If the new growth is too dense it will prevent the fruiting wood from maturing, and poor crops will be the result. The thinning out of the summer growth will overcome this crowding and weakening of the fruiting wood.

Many fruits will be ripening during the month. Do not permit the fruit to become over-ripe on the trees; rather harvest it at the correct stage and store or sell the surplus.

Plant shelter trees if the orchard is exposed to the prevailing winds, as good crops of fruit cannot be expected from inadequately protected fruit trees.

CROPS.

If not already sown, put in the ensilage and fodder crops at once, such as maize and legumes, oats and other hay grass crops. Sow short season crops like haricot beans, linseed, buckwheat, peas, summer oats, gram and mung bean. Plant out grasses and kudzu vine for pasture. Ridge potatoes and cultivate thoroughly. Main crop can still be planted. Quick growing green manuring crops, such as cowpeas, soya beans and sunn hemp, may still be sown this month. Earth up ground nuts so that a small amount of loose soil is thrown over the crowns of the plants. This assists the formation of nuts. If not already done and where practised, legumes or long season oats such as Algerian can be sown under the maize crop for grazing and to add nitrogen and humus to the soil. Cultivate all growing crops well, and thoroughly eradicate weeds. Overhaul all hay-making implements and ploughs and get in thorough repair in preparation for the haying and ploughing seasons. Endeavour to mow grass fields early for hay and litter, and to obtain second cutting for hay in April. Fallowed lands or fields not yet planted may be disc-harrowed or ploughed to prevent weeds from seeding. Mow grass paddocks infested with annual weeds to prevent the weeds seeding. Prevent Mexican marigold and other noxious weeds seeding by hoeing or pulling out the plants by hand. Keep a sharp look-out for maize stalk borer. Cut off the tops of infested plants or treat them with a recognised chemical preparation. If topping is practised, remove tops from land, and bury, burn or feed them at once to farm stock. Watch the maize lands for witch weed. Prevent witch weed plants from seeding by cultivation and by hand-pulling the plants. Make as much manure as possible by placing grass and litter in cattle kraals, pig sties and stables. If there is stumping and clearing to be done, push on with it. Endeavour to get as much of the new virgin land as possible broken up during this and the two following months.

ENTOMOLOGICAL.

Maize.—Late planted maize, particularly crops planted after the New Year, are frequently attacked by the maize stalk borer (*B. fusca*, Full.) in districts where this pest is prevalent. The yield of grain from heavily attacked stands is usually very low, and such crops are most economically used as ensilage. Plants attacked are easily detected in the fields, as the newly hatched caterpillars eat the young leaves before entering the stalk. Top dressing with a suitable insecticide should be employed to ensure a good yield. There are several insecticides which can be used for top dressing which kill the young caterpillars without causing severe injury to the plant. Kerol, Kymac or Hycol used at a dilution of 1 in 300, or Pulvex, 1 in 54 gallons of water, give satisfactory results. A new preparation, Derrisol, is highly recommended by the manufacturers at 1 in 1,000, and is stated to be quite innocuous to the plants. The liquid should be poured into the funnel-shaped cup formed by the young leaves. Only those plants showing attack are usually treated. With a light infestation, one native can treat about five acres per day. Several treatments may be necessary. Young maize plants up to six weeks old can be treated by cutting the plant below the point attacked. The portions cut off must be removed from the lands.

Various leaf-eating insects (including the snout beetle (*Tanymicus destructor*), the surface beetles, grasshoppers, etc.) attack young late-planted maize.

The attack by the snout beetle may be very severe. If there is time, it is often advisable to harrow in the old crop, treat the land with poison bait and re-plant, or poison bait may be used without removing the crop. The best carrier for poison bait is chopped Napier fodder or some other green succulent grass, including maize itself; failing this, maize or wheat bran may be used. The carrier is thoroughly covered or impregnated with a solution of arsenite of soda 1 lb., molasses $1\frac{1}{2}$ gallons, or cheapest sugar 8 lbs., water 10 gallons, and broadcast. The cheapest arsenite of soda to employ is locust poison, diluted 1 in 200, and equivalent quantity of sweetening agent added. The best results are obtained if the broadcasting is done in the evening, as the hot sun dries up the bait too quickly and renders it unattractive to the beetles.

Army Worm (*Laphygma exempta*) may put in an appearance during the latter half of December, and a sharp look-out should be kept for the caterpillars, especially on sweet grasses near the maize lands and on "rapoko grass" (*Eleusine indica*) on the lands. (See *Rhodesia Agricultural Journal,* October, 1930, page 1055.)

Black Maize Beetle.—Both larvæ and adults of this beetle are active during this month. Hand collecting of the adults is the only practical procedure. For further control measures, see *Rhodesia Agricultural Journal,* February and April, 1925.

Potatoes.—This crop, if attacked by leaf-eating ladybirds, blister beetles or other leaf-eating insects, may be sprayed with arsenate of lead (powder), at the rate of 1 lb. in 25 gallons of water. This poison may be combined with Bordeaux Mixture when spraying against early blight. To protect potatoes from potato tuber moth, the rows should be ridged deeply and the tubers kept covered with soil.

Tobacco.—Tobacco in the field is attacked by many insects during this month, and growers should keep a copy of Bulletin No. 665, "Tobacco Pests of Rhodesia," handy for reference, or refer to *Rhodesia Agricultural Journal* for January, 1928. The following very brief account of the more common insect pests attacking this crop may help the grower who cannot consult the above-mentioned bulletin.

Cutworms.—Keep all lands free from weeds up to the time of planting out.

Stem Borer.—All seedlings showing the characteristic swelling should be destroyed by fire. Plants in the field should be destroyed and replaced, or the plant may be cut off below the swelling and one sucker encouraged to grow. The latter procedure needs to be carried out early.

Leaf Miner.—All primings should be destroyed, and infected leaves may be picked off.

Seed Beds.—Seed beds which are no longer required should be cleaned up and not allowed to become a breeding ground to infest the fields. Beds in use should be kept properly covered with limbo and sprayed weekly with arsenate of lead, 1 lb. in 30 gallons of water.

Wire Worms (*Trachynotus* spp.).—Several species of wire worms attack this crop during January, particularly on sandy soils. It is now too late to attempt control. Control depends upon the accurate timing of the emergence of the adult beetle and poisoning with a poison bait. Emergence usually takes place late in April or in early May. The bait consists of maize meal or bran poisoned with arsenite of soda (locust poison, 1-200). The bait is made up into balls, scattered about the lands. The balls should be covered with leaves, to give attractive shade and to assist in keeping the bait moist. Moisture should be added when necessary.

Surface Beetles (*Zophoses* spp., *Gonocephalum* sp.).—The same control measures apply as for wire worm. Baits recommended against wire worm can be applied during January. No sweetening matter is necessary.

Bud Worm (*Heliothis obsoleta*).—Destroy all caterpillars by hand during "topping." Examine all bagged seed heads weekly and destroy any caterpillars discovered.

Other Leaf-Eating Caterpillars.—A bad attack in the field may be controlled by spraying with arsenate of lead (powder), 1 lb. to 30 gallons of water. A knapsack spray pump with a cyclone nozzle is necessary. Hand picking may be employed.

Beans, Cowpeas, etc.—Haricot beans and cowpeas are liable to attack by the stem maggot (*Agromyza* sp.). This small fly deposits its eggs in the young leaves, often within a few days of germination. The larvæ mine along the veins and down the stem, pupating about soil level. Practically nothing can be done to protect a field crop. Velvet beans, Jack beans and dolichos beans are not attacked by this pest.

All varieties of beans are attacked by a leaf-eating beetle (*Ootheca mutablis*). This small insect can be controlled by spraying with arsenate of lead (powder), 1 oz. to 3 gallons of water.

Blister beetles are often very numerous on the flowers of all species of beans and cowpeas. Hand collecting has been found to be the most economical measure.

The bean stem weevil is a minor pest of beans in the kitchen garden. All plants attacked by this weevil should be picked out and burnt.

Sweet Potatoes.—Sweet potatoes may be attacked by caterpillars of the sweet potato sphinx moth. These should be collected by hand.

Kitchen Garden.—Marrow and cucumber plants about to set fruit may be sprinkled regularly with the following formula to destroy fruit flies which "sting" fruit :—Arsenate of lead (powder), 1½ ozs.; molasses, ½ gallon, or cheapest sugar, 2½ lbs.; water, 4 gallons. To destroy leaf-eating insects generally, dust plants with arsenate of lead (powder), 1 part in 20 parts of finely-ground maize meal or finely-sifted slaked lime. *Aphides* (plant lice) may be treated with soap, 1 lb. in 5 gallons of water, or tobacco wash, or simply by regular spraying with a forceful stream of cold water from a spray pump.

Fruit Trees.—Deciduous fruits are subject to attack by large beetles, which should be destroyed by jarring into a net and dropping thence into a tin containing water, with a film of paraffin on the surface. Trees should be covered in mosquito netting to protect the fruit from fruit-piercing moths. The large adult beetles of the fig borer may be seen on the young shoots and should be destroyed. Borers in the trunks of the trees may be killed by injecting a little carbon bisulphide.

Mosquito, House Flies, etc.—Screen windows and doors. Destroy breeding places around homestead. House flies may be poisoned cheaply with sweetened arsenite of soda solution. Write for directions.

When in doubt as to the identity of any pest or the method of dealing with it, apply promptly to the Chief Entomologist, Salisbury, bringing or sending specimens of the insects concerned. Note, however, that it is sometimes feasible to prevent injury from pests for which no practical remedy is known. Farmers should therefore endeavour to obtain some knowledge of the pests of the crops they are growing through the articles published in this Journal.

FLOWER GARDEN.

This month requires all one's energy in the flower garden. Annuals may still be sown for late flowering before the season is over. Planting out should be done as early as the weather permits, and advantage taken of a dull day after a shower for this work. If care be exercised much smaller plants may be put out than would at first be thought advisable, as with attention these will make stronger plants than larger ones, which are more likely to receive a check. The soil requires constant stirring, owing to the

packing caused by the rains and for the eradication of weeds, which are now very troublesome. All plants should be kept free of dead and decaying matter.

VEGETABLE GARDEN.

Turnips, carrots, cabbages, lettuce, etc., may be sown for carrying on during the winter months. Potatoes may be planted this month for keeping through the winter. Weeding and cultivating between the rows should be continually carried on.

FORESTRY.

If the rains are seasonable, plant out evergreen trees, such as gums, cypress, pines, etc. Fill in all blanks as soon as they are noticed, and do not leave them until the following season. Planting should be done on a wet day, or, failing that, on a dull day, or late in the afternoon. Great care should be taken to see that the trees are not planted out any deeper than they stood in the tins.

POULTRY.

All houses must be absolutely watertight, the floor raised well above the level of the surrounding ground, thus preventing water seeping in and making it damp. The birds themselves should not get wet, and no pools of water should be seen in the runs.

Foodstuffs must be kept absolutely dry, otherwise they will become mouldy and sour, causing disturbance of the intestinal tract, illness, and perhaps death; certainly a diminution in the number of eggs.

Some of the birds will now be in moult. To get them through it quickly give more sunflower seed, some monkey nuts, plenty of green food, especially cabbage, kale, etc., plenty of milk or some meat, a little sulphur in the dry mash (one teaspoonful to 1 lb.); also stew two dessert spoonfuls of linseed in a pint of water to a jelly, mix this to a crumbly consistency with mealie meal or bran, and give about one dessert spoonful to each bird daily. Keep the birds dry during the rains, otherwise the egg output will decrease.

Do not hatch any more turkeys till after the rainy season is over. Turkeys should not be penned up, but allowed on free range.

Ducks must be treated in almost exactly the reverse manner to what turkeys are. They should be kept in a small run; nearly all their food should be wet mash, bran, pollard, mealie meal, meat meal and milk, as much as they will eat three times a day, *i.e.*, they should practically be allowed to spend their existence eating and sleeping. Big duck breeders often give a fourth meal by lamplight at 10 p.m., and the first meal is given at sunrise.

STOCK.

Cattle.—Put the bulls into the herd now to secure spring calves. The bulls should be in good condition at the commencement of the service season and their condition should be maintained while they are working. This season calves should be looking well by this time and care must be taken not to over-milk the cows in consequence. Cows rearing calves should not be milked more than once a day. Hand-reared calves should be kept in dry, clean quarters. In the warmer weather they often do better if they are kept indoors until they are three or four months of age. Bullocks which are being fattened on grass should receive a concentrate ration from now onwards. During this month a protein concentrate should usually be added to the milch cows' ration.

Sheep.—Keep the sleeping quarters as dry as possible. Keep the sheep away from vleis and "rotate" the grazing as much as possible. Sheep are liable to suffer severely from internal parasites from now onwards.

DAIRYING.

During the months of December and January veld grazing is usually plentiful, and very little extra feed in the form of concentrates is required for dairy stock. It should be borne in mind, however, that heavy milking cows are unable to satisfy their requirements for milk production from veld grazing alone, and should receive a daily allowance of grain; the latter should be fed at the rate of 2 lbs. for every gallon of milk produced daily, i.e., a cow producing three gallons of milk should receive 6 to 7 lbs. of concentrates. An excellent mixture for this purpose is one consisting of four parts maize meal and one part ground-nut cake.

During wet weather, the provision of a clean dry shelter for calves is essential; the latter should not be crowded together in a small, damp, badly ventilated pen or muddy kraal. When treated in this manner, a calf is very liable to contract various ailments such as scour, etc. Scour is entirely preventable, and is usually caused by over feeding, or feeding from dirty pails, feed boxes, etc. Calves which contract scour should be isolated, the milk ration reduced, and they should be dosed with a few tablespoonfuls of castor oil.

Under the weather conditions which now obtain, cream should be despatched to the creamery at least three times a week. It is of the greatest importance that cream should be cooled immediately after separation, and should be kept cool while on the farm and whilst in transit to the railway station or siding. While the cream is being cooled, it should be frequently stirred, using a stirrer with a plunger attachment. Warm, freshly separated cream should not be mixed with old cream which has already been cooled. Cool the fresh cream first and then mix thoroughly with the old cream. Gassiness is a common defect in the cream received at the creameries at this time of the year, and is caused by gas-producing organisms with which the milk and cream are contaminated. These organisms abound in mud, manure, etc., and develop and multiply very rapidly at high temperatures. Any precautions therefore which may be taken to eliminate dirt, manure, etc., from the milk and to keep the cream cool will prevent the development of gassiness.

As the night temperatures are fairly high, cheese-makers should not attempt to use night's milk for cheese-making; morning's milk plus a starter will give the best results. Gouda cheese-making operations are not usually successful at this season of the year, owing to the poor quality of the milk and the prevalence of gassiness. This type of cheese is best manufactured during March and subsequent months.

TOBACCO.

Cultivation should be systematically continued, and no foreign vegetation allowed in the tobacco field, as weeds and grass induce insect attacks. All backward plants should be given special attention, and an additional application of fertiliser to hasten growth, so that the plants ripen as uniformly as possible. Curing barns should be placed in proper condition on rainy days, and all tobacco appliances should be placed in proper order for the rush of work during the curing season. Early planted tobacco may be ready for topping during the latter part of the month, and the common mistake of topping too high should be avoided. Go over the field carefully and select typical, uniform and disease-free plants for producing seed for next season's crop. All plants should be properly primed at the same time that the tobacco is topped.

VETERINARY.

Horse sickness may now be expected, especially in districts where early heavy rains have occurred. Blue tongue in sheep will also be prevalent.

WEATHER.

Heavy rain is to be looked for, and during this month we may normally expect nine to twelve inches on the eastern border, eight in the north, and seven to seven and a half as one travels westwards or southwards. At this time of the year the rainfall tends to be heavier in the eastern than in the western portions of the Colony, whilst prolonged steady rains take the place of the thunder showers which marked the earlier part of the wet season. The growing period is at its height, and high temperatures are registered.

February.

BEE-KEEPING.

In most parts of the two Rhodesias this month is one of fair activity for all bees, there being as a rule quite enough nectar, pollen, etc., available for all ordinary purposes of rearing, building cells, etc., and working generally for the due upkeep of the colony for the present as well as for the coming winter. Whether there will be any surplus honey for them to store will depend upon what crops the farmer may have on hand at this time, as the usual flora of the land will not supply it until the regular second flow of the year is due, which should be in March to April, according to the season.

Watch carefully for robbers, though, with well attended hives and due care in handling, there should be little to fear in this direction; strong, well filled hives can always repel robbers, which are only successful with weak colonies, and these no apiarist should ever have under his care. Mark well last month's advice, i.e., to have everything in readiness for dealing with unexpected new swarms that may be required as they may come, for nothing is more disconcerting or annoying than to be unready when the time arrives. This applies especially to any swarms that may come from the apiary, for a few days only of neglect of such a hive may easily lead to the moth taking early possession of the combs, and in practically a few hours destroy fully drawn-out combs that would otherwise be of much value for after working upon. Such combs, as they are available, should at once be packed away in an air- and moth-tight box or tin for after usage.

CITRUS FRUITS.

Newly-planted citrus trees should be kept free of weed growth likely to exclude necessary air and light for their normal and healthy development. Citrus trees planted in February seldom give satisfactory results; late planted trees do not mature their new growths before winter, and they are more susceptible to winter injury or the ravages of disease or insect pests. The early planted cover crops will be fit to plough under by the end of the month. Do not delay this operation for fear of the rains ending abruptly. If this occurs, great difficulties will be experienced when attempting to plough in the green crops. Keep all young shelter belt trees free of weed growth, and loosen the soil round their stems fairly frequently to eliminate possible ant injury. This is one of the best months for budding citrus trees, either in the nursery or grove—trees that are to be top worked to profitable varieties. Late out-of-season fruit that may have set during December-January should be stripped from the trees. This fruit is valueless for export, and if allowed to mature, will affect the main crop setting of fruit.

DECIDUOUS FRUITS.

When sufficiently mature, plough under cover crops. This should be possible towards the end of the month.

Summer pruning should be completed early in the month; little or no advantage will be derived from trees treated when the new wood reaches maturity.

Do not allow fruit to become over-ripe, then expect remunerative prices for it. If it is harvested at the correct stage, then well graded and neatly packed, good prices may be expected for the surplus fruit sold.

This is a good month for budding deciduous fruit trees.

CROPS.

Cultivate, and keep on cultivating as weather permits, to destroy weeds. Continue to look out for stalk borer, and, if infection is discovered, deal with infested plants as advised in January notes. Watch witch weed and continue cultivating and hand pulling it. Plough under witch weed, smother and trap crops. Where practised, maize can be under-planted with sweet potato vines after the last cultivation for the following season's requirements. Potatoes and ground nuts will probably need to be ridged again. Catch crops of quick maturing beans, such as tepary bean, also buckwheat, can still be sown. Keep down all noxious weeds. This work can be undertaken on wet days. Make veld grass hay whenever a few days of fine weather permit. Early mowings provide the best hay. Seed beds of onions for early winter planting can be sown towards the end of the month. Keep potatoes in a cool shed, well ventilated. Pick over any potatoes in storage and remove bad ones. Continue to make as much farm manure as possible. Begin to ride manure and place in heaps handy to the lands to be manured.

ENTOMOLOGICAL.

Maize.—The first brood of the stalk borer matures this month, and the young of the second brood may be found amongst the younger leaves. Weeds should be kept down.

Tobacco.—Stem borer, leaf miner and budworms are the chief pests likely to be troublesome. Plants in the field found infested with the first two insects should be heavily pruned or destroyed. The budworm caterpillars can usually be hand picked during the process of topping. (See "Rhodesia Agricultural Journal," December, 1927.)

Potato.—Ladybirds and tuber moth may call for attention. The latter, when very bad, sometimes causes considerable wilting of the crop besides attacking tubers. The ladybirds may be destroyed by spraying with arsenate of lead 1 lb. to 16 gallons of water.

Cabbage Family.—All members of the family are liable to be attacked by the sawfly and webworm. The sawfly may be effectively controlled by dusting during a dry spell with Paris green and slaked lime (1 lb. Paris green and 20 lbs. slaked lime).

Melon Family.—The most important pest is the melon fly, which "stings" the fruit of all species of gourds. Destroy all badly "stung" fruit and spray remainder thoroughly with arsenate of lead (2 ozs. in 4 gallons of water) to which 2½ lbs. of cheap sugar has been added.

Deciduous Fruit.—Apples, pears and late peaches suffer chiefly from fruit moths, which puncture the fruit. No remedy available except covering the trees with netting.

Fig.—The fruit is liable to the attack of the fig weevil. All infested fruit and all wild fruit should be collected and destroyed. The borer in the stem may be killed by inserting a little carbon bisulphide into the burrow and sealing it up.

Poison Baiting.—Poison baiting against surface beetles, cutworms, etc.: No really effective bait has yet been discovered for cutworms, but the following poisoned bait is recommended for surface beetles, etc.: Paris green 1 lb., 180 lbs. maize meal. Mix thoroughly in dry state and add water until the material is of the consistency of a dough. Roll into small balls and place under shade. Spread in the evening.

FLOWER GARDEN.

Sow carnations, phlox, pansy, verbena, gilias, larkspur, dianthus and pentstemon. The flower garden should be now looking its best, nearly all plants being in bloom. Old and dead flowers should be constantly removed, except when the seed is required. Seeding of the plants shortens their flowering period. All runners and climbers should have constant attention, and be tied up and trained, otherwise they will be damaged by the wind. Dahlias, chrysanthemums and carnations will require staking, as they become top heavy when in flower. Make the first sowing of winter-flowering sweet peas.

VEGETABLE GARDEN.

Sow now—Beans, beet, cabbage, cauliflower, lettuce, peas, onions, carrots, parsnips, turnips, endive, kohl rabi, rhubarb and all herbs.

FORESTRY.

Tree planting operations should be carried out on dull, showery days or late in the afternoons. Take care in setting out the plants, avoid bending the roots, and do not plant deeper than the plants were in the seed beds or trays. Steps should be taken to prepare seed beds for the slower growing species, i.e., pines, cypresses and callitris, and seed of these species should be sown for the following season's planting.

GENERAL.

This is a busy time for the farmer. Weeds will be very much in evidence and difficulty will be experienced in keeping them under. Stock will have fully recovered their condition, but ticks will be troublesome. The dipping tanks must be fully utilised now.

POULTRY.

Cockerels for future breeding should now have been selected, and those not good enough sold for killing. It pays far better to get rid of all of the latter, even if only at 1s. or 1s. 3d. per lb., than to keep them on, eating their heads off, in the hope of getting a better price. Those good enough for breeding, and they must be good, should be kept till about June; there is a demand for such up to this month. Any surplus at this time should be eaten or sold for what they will fetch. Of those selected for breeding purposes, the owner should keep the best one or two for his own use, with another as a reserve. No poultry keeper should sell his best stock, no matter how high a price is offered for it.

By the end of this month the birds selected for breeding should be mated up. If it is possible, the birds selected for breeding should be given a run on free range for three weeks or so before being put into the breeding pen and fed sparingly; better fertility and better chicks will be the result. If it is possible to run the birds selected for breeding away from the others during the whole of the breeding season, all the better. Any hens that become broody should be kept broody by setting a few china eggs under them until such time as eggs from the breeders come in. Broody hens at this time and for the next five months are valuable.

During the rainy season the scratching litter must be kept dry; if it gets wet it is useless.

Duck hatching can be continued all the year round; the main points are that the young ducks must be kept out of the sun and sleep on dry grass. Nothing is more fatal to ducklings than sun, and dampness at

night; and the latter applies, too, to the adults. Unless a dry shed, with a dry, soft layer of chaff or sand, etc., covering the floor of it, is available, it is not wise to hatch turkeys till after the wet season is finished, for it will be labour, food and eggs wasted. If the young turkeys get wet they are almost certain to die. This and the feeding on wet mashes instead of dry food, chopped onions and thick milk are the chief reasons for non-success in the breeding of turkeys.

STOCK.

Cattle.—The recommendations for December apply equally to this month. Be careful that the condition of the bulls is maintained, especially in the case of well-bred animals. A bull in poor condition cannot be expected to sire a large number of calves. As far as practicable cut veld hay during this month. Usually the optimum relation of yield and composition occurs now. During this month, in addition to maize, some protein concentrate such as peanut cake or cotton-cake will generally be necessary in the dairy cow mixture to keep up a good milk flow. Increase the grain ration to bullocks which are being fattened on grass and add some protein concentrate to their feed to make good the deficiency of this nutrient in the grazing.

Sheep.—Continue as recommended for December. If heavy rains are experienced, a daily ration of half a pound of maize per ewe will help to keep them in condition. Those who favour autumn lambs must put the ram again with the flock in February, and should take steps to supply a little extra feed to fit the ewes for mating. Start putting in green feed for ewes due to lamb in April or May.

DAIRYING.

This is normally the flush season as far as dairy produce is concerned; dairy cattle are usually in good condition, and cows of average capacity should be able to subsist and maintain a full flow of milk on veld grazing alone. Calves may be given a few hours' exercise on bright, sunny days; young stock, however, should not be allowed to run and graze with the herd, and are best kept in a cool, airy pen opening on to a small shady paddock where they can obtain a little exercise.

A good quality of sweet hay and water should always be available for young calves.

Cream deteriorates very rapidly under the conditions which obtain at this time of the year, so that every precaution should be taken to keep the cream as cool as possible pending despatch to the creamery. As there is a greater strain than usual on the separator during the flush months, frequent oiling is necessary, and care should be taken that the machine is mounted on a level foundation. The separator and all other dairy utensils must be cleaned immediately after use. First rinse the utensils with cool or lukewarm water, then wash thoroughly with boiling hot water, washing soda and a scrubbing brush; scald finally with boiling water.

The cheese in the storeroom is apt to develop mould during wet weather. If the cheese is well made and pressed and has a smooth rind, this mould is merely superficial and will not penetrate into the body of the cheese. Rubbing the cheese with a cloth moistened with a weak solution of formalin or permanganate of potash usually checks the development of mould. During these months care must be taken not to use over-acid milk for cheese-making, and great care should also be taken of the starter. If this latter shows any signs of gasiness or develops any disagreeable flavour or odour, it should be discarded and replaced by a fresh, clean starter. The cheese storeroom must be kept dark and flies excluded.

TOBACCO.

The early tobacco should now be ready for curing. Care should be taken to select only thoroughly ripe leaf for filling the barns, so that the

cured product will be uniform. Topping, priming and suckering should be given attention. Selected seed plants should be carefully watched. New land intended for tobacco next year should be ploughed this month, so that all organic matter turned under may be converted into humus before planting time next season.

WEATHER.

This is often the wettest month of the year, with marked differences of from 10 inches to 15 inches on the eastern mountain ranges, 7½ inches over Mashonaland, 4 inches to 6 inches in Matabeleland, and least, but still some, rains in the Limpopo Valley. The rains may be expected to decrease in intensity after the middle of the month if the season is normal.

NOTES FROM THE *GAZETTE*.

"*Gazette*" *Date.*	*Items.*
	DAIRY PRODUCE ACT, 1925, and DAIRY INDUSTRY CONTROL ACT, 1931.
18.11.32.	Government Notice No. 657 reads as follows:—

"It is hereby notified that His Excellency the Governor-in-Council has been pleased, under and by virtue of the powers conferred by the 'Dairy Produce Act, 1925,' and the 'Dairy Industry Control Act, 1931,' to make the following regulations:

"1. Section 10 of the regulations published in the schedule to the 'Dairy Produce Act, 1925,' is amended by the addition of the following sub-sections:—

"(3) Notwithstanding anything to the contrary contained in sub-section (1), any person shall be guilty of an offence who adds to or mixes with milk or cream any preservative preparations, if such milk or cream is sold or supplied or is intended for sale or supply to a creamery or cream depot in order that butter may be made therefrom.

"(4) Any owner or manager of a creamery or cream depot shall be guilty of an offence who makes butter from any milk or cream to or with which any preservative preparation has been added or mixed.

"(5) Any person shall be guilty of an offence who imports into the Colony any milk or cream to or with which any preservative preparation has been added or mixed, if it is intended that butter be made from such milk or cream.

"2. The amendments set out in section 1 hereof shall come into force on the 1st December, 1932."

SOUTHERN RHODESIA VETERINARY REPORT.

October, 1932.

AFRICAN COAST FEVER.

Melsetter District.—The temperaturing of the infected herds *ex* Glencoe was completed on the farm Hayfield. No cases of Coast Fever occurred.

FOOT AND MOUTH DISEASE.

Insiza District.—No fresh outbreaks. This district is now regarded as free from infection.

Gwanda District.—No fresh outbreaks. The cattle concentrated on the farms Timber and Deneys failed to react to the inoculation. All were re-inoculated on 23rd October.

Gwelo District.—Three fresh outbreaks occurred in the vicinity of the infected area on Goldfields South—viz.: on the farms Wyanko, Tweestroom, and the Bembezaan section of Rhodesdale Ranch. All the cattle involved—4,823 head—were concentrated and inoculated. As the Central Homestead section of the Rhodesdale Ranch appeared likely to become infected, all cattle thereon were inoculated.

From field observations, it appears that young calves possess a considerable resistance to infection by contact or inoculation. Under favourable conditions, the District Veterinary Surgeon, Umvuma, inoculated six calves intramuscularly with 2½ c.c. of virus and two intra-nasally with 2½ c.c. of virus in each nostril. Four of the former gave typical dental pad and feet lesions, and none of the others showed any reactions. Further, various field observations suggest that calves born whilst the dams are suffering from an attack of foot and mouth disease and subsequent thereto possess a complete immunity.

ANTHRAX.

Anthrax infection appeared in cattle on three farms in the Beatrice section of the Hartley district, one farm in the Salisbury district and a plot on Mount Pleasant. All cattle directly and indirectly involved—a total of 1,660 head—were vaccinated.

TRYPANOSOMIASIS.

One case in Melsetter district.

SCAB.

One flock placed under licence in the Gwelo district.

IMPORTATIONS.

From the Union of South Africa and Bechuanaland Protectorate: Bulls, 6; horses, 3; sheep, 1,441; goats, 72.

EXPORTATIONS.

Nil.

J. M. SINCLAIR,
Chief Veterinary Surgeon.

SOUTHERN RHODESIA WEATHER BUREAU.

NOVEMBER, 1932.

Pressure.—The mean barometric pressure varied from normal to one millibar above normal.

A high remained over Southern Rhodesia from the 1st to the 4th and then faded. The second appeared off the south-west coast on the 6th, but passed on without affecting local conditions. The third appeared on the south-west coast on the 8th, and passing round the coast was over Southern Rhodesia on the 12th and then faded. The fourth high appeared on the south coast and remained over Southern Rhodesia up to the 18th. The fifth high appeared on the south-east coast on the 19th, was over Southern Rhodesia on the 21st and then faded. No highs of importance appeared later in the month.

The first two lows appeared on the south-west coast on the 1st and 3rd, but passed off. The third appeared in the south-west on the 7th, and in conjunction with the equatorial low moved round the coast, and a weak trough traversing Southern Rhodesia on the 9th was associated with light rain. Three succeeding lows appeared on the 11th, 15th and 17th, but affected conditions very little; but the seventh, which appeared on the 20th, remained on the coast for several days while the equatorial low developed. Rain commenced on the 24th, and on the 27th the trough passed through Southern Rhodesia. The equatorial low remained over the Union until the 30th, when a general rise of pressure occurred.

Temperature.—The main temperature of the month was generally above normal.

Rainfall.—The rainfall for the month was 2.9 inches—about 0.3 inch below the average. The deficiency occurred in the south, and the rainfall in the north-east was above normal.

NOVEMBER, 1932.

Station.	Pressure Millibars, 8.30 a.m.		Temperature in Stevenson Screen ° F.								Rel. Hum.	Dew Point	Cloud Amt.	Precipitation.			Altitude (Feet).
			Absolute.		Mean.												
	Mean.	Normal.	Max.	Min.	Max.	Min.	½ Max. Min.	Normal.	Dry Bulb.	Wet Bulb.	%	F.	0-10	Ins.	Normal.	No. of Days.	
Bulawayo ...	868.7	867.8	94	49	87.3	61.8	74.6	72.6	74.5	60.0	42	50	4.7	0.75	3.2	5	4,436
Gwelo	862.9	...	95	42	86 0	59.3	72.7	73.6	72.8	60.6	48	52	4.5	3.59	3.7	6	4,638
Riverbank ...	...	...	105	50	92.8	63.5	78.1	76.5	76.2	61.9	43	52	4.9	1.53	2.2	9	4,100
Gwanda ...	905.7	...	101	51	90.5	64.5	77.5	...	77.6	62.4	41	52	3.0	0.20	2.2	3	3,235
Mazunga ...	948.1	947.6	106	52	93 4	64.9	79.1	78.2	78.5	66.4	52	60	4.1	0.51	2.1	3	1,970
Nuanetsi ...	...	...	104	51	91.9	64.0	78.0	...	75.8	66.4	61	61	4.9	0.40	2.9	3	1,630
Between Rivers	...	...	96	46	87 9	59.1	73.5	...	74.5	61.7	48	53	3.9	2.13	2.4	9	3,970
Enkeldoorn ...	858.0	...	91	46	84.5	58.2	71.3	72.0	72.4	61.0	52	54	3.3	1.11	3.4	4	4,720
Gatooma ...	...	...	99	48	89.8	60.3	75.1	77.0	75.3	63.3	51	55	3.4	3.32	2.9	7	3,850
Miami	878.3	...	95	50	86.2	62.0	74.1	...	73.5	61.7	51	54	3.1	1.30	2.3	8	4,090
Salisbury ...	855.3	854.9	90	46	82.8	59.3	71.1	71.9	71.8	59.7	48	51	3.8	2.39	3.3	9	4,890
Sinoia ...	887.8	...	97	46	88.4	59.7	74.0	...	75.9	61.7	43	52	3.5	2.29	3.2	8	3,804
Sipolilo... ...	...	...	93	52	85.6	64.0	74.8	...	75.1	62.1	47	54	2.7	1.40	3.3	5	3,900
Mtoko	...	...	92	52	84.8	60.6	72.7	...	73.1	61.8	52	55	2.1	1.13	3.3	3	4,210
Bindura ...	...	...	95	53	86.2	63.3	74 8	...	72.4	61.9	55	55	3.0	3.54	2.8	8	...
Angus Ranch ...	...	...	103	58	90.7	66.8	78.7	79.7	78.7	66.5	52	60	...	2.32	1.8	6	2,300
New Year's Gift	...	...	98	51	85.5	61.1	73.3	...	72.4	64.1	63	60	...	2.25	3.0	8	2,700
Nyamasanga ...	...	...	90	45	81.0	56.2	68 6	...	70.3	61.3	60	55	2.7	4.77	...	8	5,080
Umtali	893.3	893 2	95	47	82.9	59.6	71.2	72.6	71.7	62.5	59	56	4.3	2.58	3.7	9	3,677
Victoria ...	895.9	895.0	97	44	88.0	61.1	74.6	72 7	75.2	62.8	50	55	4.2	1.14	3 0	4	3,570
Melsetter ...	850.9	...	89	50	77.4	55.8	66.6	...	70.5	59.1	53	52	4.1	2.65	5.0	5	5,060
Mount Selinda	...	...	92	43	81.0	59.2	70.1	..	68.5	61.8	69	58	4.5	1.67	5.0	9	3,520
Manchester ...	...	...	85	42	73.0	53.5	63.3	...	57.2	54.7	85	53	...	7.03	...	10	...

Rainfall, November, 1932, in Hundredths of an Inch. Telegraphic Reports.

Area	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Total.
1	...	...	...	2	...	...	6	3	...	5	...	...	1	...	...	...	...	...	...	...	...	...	...	8	...	10	2	27	15	33		112
2	...	...	...	...	...	6	...	10	11	1	1	...	...	...	...	...	...	...	...	...	...	...	...	2	26	44	1	13	65	21		201
3	...	...	...	...	...	...	...	...	77	5	2	...	...	1	...	...	...	...	5	1	...	...	...	36	14	61	...	5	2	64		273
4	...	...	...	...	...	...	...	1	9	...	...	...	2	...	...	...	...	...	...	...	...	...	15	32	16	8	4	110	15	40		252
5	...	...	...	...	...	...	2	...	...	...	...	...	5	...	...	...	...	...	...	...	...	...	1	6	...	16	12	53	1	3		99
6	...	...	...	...	...	...	10	...	10	...	5	...	1	...	...	...	...	...	...	...	...	...	...	1	10	21	56	28	42	26		210
7	...	...	...	...	...	...	...	...	87	1	9	...	3	...	...	...	...	...	...	...	...	...	...	32	4	47	48	49	62	5		347
8	...	...	...	...	...	...	...	...	52	32	10	...	...	11	...	...	...	...	...	...	...	...	...	9	9	31	126	7	122	15		424
9	...	...	...	...	...	...	44	...	17	17	...	...	...	11	...	...	...	...	...	...	...	...	...	5	15	15	33	4	21	17		199
10	...	...	...	...	...	9	...	...	4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	59	...	1	35	...	15	...		123
Mean	...	...	...	...	...	1	8	2	17	4	2	...	2	2	...	...	...	...	...	...	...	...	1	13	9	22	24	33	31	19		190

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EDITORIAL.

Contributions and correspondence regarding subjects affecting the farming industry of Southern Rhodesia are invited. All communications regarding these matters and advertisements should be addressed to:—The Editor, Department of Agriculture, Salisbury.

Gold Medal for Southern Rhodesia Tobacco at the Toronto Exhibition.—The Canadian National Exhibition in Toronto was opened by Rt. Hon. R. B. Bennett, Prime Minister of Canada, on the 26th August, 1932. It was closed on the 10th September, having been open daily to the public from 10 a.m. to 10 p.m.

With a view to advertising Southern Rhodesia tobacco, an exhibit was prepared consisting of some 1,500 lbs. of Turkish type leaf packed in bales, as well as numerous smaller samples. This was supplied by the Turkish Tobacco Cooperative Company of Rhodesia, Ltd. Virginia tobacco exhibits consisted of 5 bales of approximately 100 lbs. each, the total weight amounting to 537 lbs., which was contributed by Messrs. H. W. Strong, L. M. Hastings, O. C. Rawson and J. Kapnek. Messrs. J. C. Elsworth and Fred Cooksey also offered material.

The tobacco exhibits are reported to have arrived in perfect condition and were very favourably commented upon by Mr. R. A. Parham, who, through the courtesy of the Imperial Tobacco Company (Canada), Limited, took charge of the decoration of the stall and arrangement of the exhibits, and who was in constant attendance throughout the entire duration of the exhibition. The number of persons who visited the exhibition is said to have totalled 1,439,000, and it is reported that the Southern Rhodesia stand was considered one of the outstanding attractions.

The Canadian National Exhibition Association has presented to the Government of Southern Rhodesia a gold medal for the excellence of the display of Rhodesian tobacco and states that the exhibit was the cause of much favourable comment and general interest. As a personal memento of the co-operation and assistance rendered by him a replica of the medal in bronze has also been awarded to the Hon. J. W. Downie, C.M.G, High Commissioner for Southern Rhodesia.

From the standpoint of publicity the Rhodesian exhibit has proved an unqualified success, but if further results are to be achieved it will be necessary for tobacco growers themselves to follow up the interest already aroused by making personal endeavour to cultivate the Canadian market and interest manufacturers there in our product.

The Improvement of Grass Types by Breeding.—To the average individual and to the majority of farmers, grass is grass. One wonders sometimes how many stock-owners in this Colony observe at all closely the different grasses occurring on their farms, the seasons of the year when they prove of greatest value and their other desirable or undesirable characteristics. Rhodesia is exceptionally rich in its grass flora, and at varying altitudes and on different types of soil a wide range of useful species is to be found.

The attention devoted of late years to problems of grassland improvement and management has brought to the fore an aspect of the problem previously entirely ignored, or at best afforded little consideration, namely the improvement of grass and other herbage plants by selective breeding.

Investigations have revealed that the scope for such improvement is fully as wide, if not wider, in this field as it is with cultivated crops.

At the Welsh Plant Breeding Station, Aberystwyth, attention is being concentrated on the breeding and trial of numerous pedigree strains of herbage grasses and clovers and a lengthy report has recently been issued, in which are discussed the yield, palatability, influence of fertilizers on, growth characteristics, aftermath production, persistency and so forth of numerous species. There can be little doubt that these investigations will shortly be rewarded by the displacement in the pastures and hay meadows of Great Britain of many less desirable types and their replacement with improved plants of pedigreed parentage.

In New Zealand similar work is in progress and particular attention is being devoted to the growing of pedigree strains of perennial rye grass. The following extracts from an article recently published on this investigation afford some small idea of its scope:—

> "The single-plant analysis is the best means of making a critical examination of a line from the point of view of type variation, either between lots of varying origin or lots of the same origin. In order to study the effect of once-growing the Hawke's Bay and Poverty Bay type of perennial rye-grass outside these districts, four thousand single plants were put out at the Plant Research Station. These plants were representative of eighteen mother-seed lines, and their first-harvest progeny was grown in twenty-two different areas."
>
> "*Comparison of mother-seed and first-harvest seed lines with regard to proportion of undesirable, open-crowned, and early-maturing types.* From single-plant analyses made of some hundreds of mother-seed lines from Hawke's Bay and Poverty Bay it has been shown that no line is of uniform type. Erect or semi-erect, dense, tussocky types of plants predominate, and it would appear that the superiority of the New Zealand certified strains is due to this erect and semi-erect dense, tussocky type. In all lines, however, there is a varying percentage of early-maturing, squat, flat, open-crowned types, which must be regarded as inferior types of plants for the purpose of high-production permanent pasture."

Samples of Mother and First-harvest seed of perennial rye grass and cocksfoot have recently been received by this Department. and it is to be regretted that owing to the very restricted conditions under which these grasses will thrive in Rhodesia, more advantage cannot be taken of the pedigreed strains obtainable from Aberystwyth and New Zealand.

The possibilities of such work are, however, well demonstrated by two local examples. In a plot of Italian rye grass sown to ordinary commercial seed in 1930 on vlei land at the Marandellas Pasture Research Station, one outstanding plant was observed in the following spring. Seed of this was collected and after being thoroughly mixed was sown in trays. Of the resulting seedlings, when about 2 inches high, sixty plants were put out in one plot 12 x 12 inches apart, and the balance in another plot at a closer spacing. In each case, as the plants advanced in growth, several widely differing types were observable, some possessing very desirable characteristics, but many with equally undesirable ones.

The second instance is the sudden appearance on the Salisbury Experiment Station two seasons ago, of a type of Gonya grass (*Urochloa bulbodes*) which, unlike the common types which propagate themselves only by seed, increases its spread by vigorous surface runners rooting at the nodes.

This was the first appearance of this grass on the Salisbury Station throughout 22 years' observations, and the indications are that the first plant of running type was a natural "sport" from self-sown seed. The grass has been identified by Kew as a new species. The desirable habit of growth of this strain may well render it of special value for pasturage.

The achievements of the Welsh and New Zealand grass-breeding stations coupled with the examples cited above afford some indication of the possible results which may be expected from grass-breeding in this Colony, where outside the Department of Agriculture little or no attention has been devoted to the study of our grass species and the varying types obtainable by selection, and through propagation from seed. The time and labour required to establish and tend a grass garden comprising small plots of what appear the most desirable types occurring in the locality and collected elsewhere could well be spared by many farmers and retired residents,

and the interest which this would afford and the practical results likely to accrue from it can not be doubted.

A.I.V. Silage.—Reprinted in this issue will be found an enlightening review prepared by the Imperial Bureau of Animal Nutrition, Aberdeen, on the much-talked of A.I.V. process of silage preservation. The report has kindly been forwarded by the Bureau in response to enquiries instituted by this Department with a view to testing the system under Rhodesian conditions. The rights of the process as far as Great Britain and South Africa are concerned are understood, however, to have been acquired by Imperial Chemical Industries, Ltd., and it is believed that Mr. R. Lindsay Robb, grassland specialist to that Company, who is well known to many Rhodesian stock farmers, and who is expected to arrive in Rhodesia early in the New Year, is bringing with him a supply of the necessary chemical preparations. It is hoped that part of this will be made available for the use of the Department. Meanwhile the enquiry commenced last year on the Salisbury Experiment Station into an alternative treatment of silage fodder with a solution of molasses with a view to conserving the original nutritive value of the material is being continued.

World's Grain Exhibition and Conference, Regina, Canada.—The construction of the new building to house the exhibits for the World's Grain Exhibition and Conference which opens at Regina on the 24th July, 1933, is completed and the surrounding gardens have been laid out and planted. The building is of permanent steel construction with stucco on the outside and is stated to be the largest in the world utilised exclusively for grain and seed exhibits.

To pass along in front of the exhibits to be staged in this building in June next will necessitate a walk of two miles, and it is claimed that during this tour the visitor will have seen something of the habits, industries, hopes and aspirations of over 40 countries, provinces and states which will participate in one form or another.

The Exhibition will be the big Canadian attraction for tourists in 1933, and the Conference will be held in regular sessions, and, it is hoped, will constitute a clearing house for world thought and knowledge on every important branch of field crop production and marketing.

Entries for the exhibition closed on the 31st January.

With the co-operation of the Division of Plant Industry, Southern Rhodesia will be represented by four exhibits of ten ears each of standard types of white dent maize. The result will be awaited with the keenest interest not only by the exhibitors and the Department of Agriculture, but also by all well-wishers of the farming industry as well as by all who have been associated in raising Rhodesian white maize to its present high standard of quality.

Not the least interesting aspect of this Colony's participation will be the opportunity afforded of judging the manner in which Rhodesia's maize compares with that of other countries.

The exhibitors from Southern Rhodesia are: Messrs. J. A. Rennie, Fort Victoria, Salisbury White variety; G. H. Cautherley, Eldorado, Salisbury White variety; the Honourable H. Gibbs, Redbank, Bulawayo, Potchefstroom Pearl variety and the British South Africa Company's Mazoe Estate, Mazoe, Hickory King variety.

The Work of the Empire Marketing Board.—*Meat Survey*: "The Empire Marketing Board are beginning the first extensive investigation ever held of national and local tastes in meat. Among the questions they are asking are the following: Which districts favour beef, pork or mutton? Where and when is fat or lean meat preferred? How do week-ends and seasons affect public taste for meat? What joints and cuts are preferred in various regions? In which areas is the market for home-grown and Empire meat capable of rapid expansion?"—*E.M.B. News*, No. 141.

"More shops are selling Empire goods and we should say from observation that they are getting a much better show. By this we mean that grocers are keeping articles well to the fore, when a year or two ago they did not think

it worth while to display them with any confidence. Stocks were kept short by many shopkeepers, who did not think it worth while encouraging Empire brands."—*Scottish Grocer.*

"The demand for Empire fruit is steadily gaining. Since the Empire Market Board was organised the developments in this particular branch of its work (Imperial Fruit Show) have been as notable as in any other branch and a good deal more so than in some."—*Fruit, Flower and Vegetable Trade Journal* (through the *E.M.B. News*).

Progress in Rhodesian Tea and Coffee Production.—An interesting New Year letter has been received from Mr. Grafton Phillips, of the Rhodesia Tea Company, Ltd., New Year's Gift, South Melsetter.

Mr. Phillips writes: "Last season we manufactured 9,300 lbs. of tea and this coming season we anticipate a crop of 20,000 lbs. At Ratelshoek we have some twenty acres planted to tea and from now on during the rains we hope to put out a further acre—2,000 seedlings—a day until the nurseries are exhausted."

"The coffee also is doing well: last year we produced 3,000 lbs., and this year we expect some 5,000-6,000 pounds weight."

Vitality of Seeds.—The following note by Mr. Ernest H. Godfrey, of Carlton, Bedford, recently appeared in *The Times*:—

> It may be interesting to recall the results of certain experiments that were undertaken some 36 years ago by the late William Carruthers, F.R.S., as consulting botanist of the Royal Agricultural Society. Carruthers never accepted the statements made from time to time as to the vitality of mummy wheat or of wheat found in Romano-British granaries, always maintaining that it was impossible for seeds buried ages ago to germinate. His experiments were undertaken with the object of testing how long, under ordinary conditions, the vitality of certain seeds was maintained, in order to help farmers and seed merchants to ascertain the real value of seeds

carried over from year to year. The seeds experimented with included cereals, pasture grasses, clovers, and root crops, and the investigation covered a period of 16 years, from 1896 to 1911. Of wheat and barley all the seeds were dead after nine years. Oats showed a greater longevity, white oats surviving until 1908 and black oats until 1910, when, however, the vitality was only 2 per cent. Of the grasses, all had failed by 1908, and of the clovers only lucerne lived to 1909, but with a germination then of but 1 per cent. The root crops had all failed by 1908. The report on the experiments, which appeared in the Society's Journal for 1911, stated that while no seed could possibly survive under the conditions in which mummy wheat and Roman granary wheat were placed, it was possible for a thick-coated seed under favourable conditions to live a very long time. Seeds of the sacred Lotus of Egypt (Nelumbo) germinated after having been for 100 years in a cabinet in the British Museum and for many years before that in Sir Hans Sloane's keeping.

Export of Ground Nuts.—The expected report by the Imperial Institute—referred to in the December Journal—on samples of Rhodesian ground nuts submitted for trade examination and valuation is reproduced in this issue. Unfortunately the extent of the trade in high class nuts in the shell and graded kernels still remains somewhat obscure, but information received by local exporters would seem to indicate that this is more limited than was at first anticipated. Further enquiry on this point is being sought and in any case it would appear that usually there is a moderate to good demand for Valencia type nuts during May and June when a shortage of Java nuts is commonly experienced.

It is satisfactory to note that in the case of crops grown on light coloured soils, washing with sand and water appears all that is required in order to give the shells the colour and bloom desired by the trade. In the case of crops grown on heavy red soils the more drastic treatment of bleaching in a chemical solution will possibly be necessary.

Increased Yields due to Green Manuring.—The Government Statistician has recently reviewed the figures relative to maize growers who have consistently practised green manuring for a period of six years, viz.: 1926-27 to 1931-32. The maize yields of fourteen farmers in the Mazoe district, five in the Salisbury district and four in other districts—a total of 23 growers—are compared with those of all other growers. The acreage planted to green manure crops by these twenty-three individuals has, as may be seen, increased progressively from year to year, thus indicating their confidence in the economic aspect of the practice:—

Year.	Total area green manured by the 23 growers.	Total area planted to maize by same 23 growers.	Total No. of bags reaped.	Average yield per acre.
1925-26	1,295	—	—	—
1926-27	1,913	9,530	88,156	9.3
1927-28	1,881	9,740	67,641	6.9
1928-29	2,422	11,652	98,553	8.5
1929-30	3,699	10,409	89,668	8.6
1930-31	4,325	8,655	81,213	9.4
1931-32	—	9,234	101,589	11.0

The average yield per acre (see last column of table above) makes interesting comparison with the average yield of the remaining maize growers of the Colony who have not green manured at all, who have not green manured consistently, or who have not green manured regularly for as long a period as six years. These returns are:—

Year.	Average yield.	Year.	Average yield.
1926-27	6.1 bags	1929-30	5.9 bags
1927-28	4.2 bags	1930-31	5.1 bags
1928-29	5.5 bags	1931-32	7.0 bags

A similar comparison may be made of the yields of regular green manurers by districts. Thus, taking the 14 regular green manurers in Mazoe, the 5 in Salisbury and the 4 in other districts, we find that their returns contrasted with those of all other growers are as follows:—

Year.	Mazoe. Bags per acre.	Salisbury. Bags per acre.	Other Districts. Bags per acre.	All Other Growers. Bags per acre.
1926-27	9.8	6.9	10.5	6.1
1927-28	6.9	7.1	7.0	4.2
1928-29	8.6	7.6	9.2	5.5
1929-30	8.7	8.3	9.3	5.9
1930-31	9.5	8.8	9.3	5.1
1931-32	10.6	13.2	10.8	7.0

The season 1927-28 was particularly unfavourable, the rainfall generally being below normal. The three following seasons were less favourable to crop growth than the past season 1931-32.

Analysing the position still further the Government Statistician comes to the conclusion that over the six years the regular green manurers have produced 193,501 more bags of maize than the non-green manurers, which, taken at the Farmers' Co-op. Society pay-out price for the respective years, represents a value of some £85,790.

Exemptions Under the Maize Control Act.—A deputation from the co-operative societies and the Maize Growers' Association recently made pressing representations to the Government to the effect that the operation of the Maize Control Act is largely nullified by the unforeseen effect of the exemptions which presently apply to the maize grown in certain districts. It was represented that these exemptions were based on the suggestion that the areas concerned produced no considerable quantities of maize and that the cost of production was greatly in excess of those incurred in the maize belt. Further, that in actual fact the greater part of the local market, which is the only market of material value, was being supplied by maize grown, or alleged to be grown, in the exempted areas, the result being that by far the greater part of the maize produced in the maize belt had to be exported at export parity. It was shown in this connection that the Control Board's sales in the local market during the first seven months of the year amounted to only 92,000 bags, and that this figure does not approach anywhere near the

actual consumption. The total production of European-grown maize in the exempted districts is probably not very great, but there would seem to be a very material production by natives. This maize has been flowing into Bulawayo and other central markets, with the result that the Maize Control Board finds itself unable to sell in markets which in the past have been largely supplied from controlled districts.

Reports from the Maize Control Board show that the total quantity of maize received into the pool during the current season amounts to about 1,582,000 bags, of which 110,000 bags represent the carry-over from the previous season, 1,330,000 bags having been grown by Europeans and 142,000 by natives. The local sales up to the 10th January have been given at 92,000 bags, and the exports at 914,000, so that the Board has still in its possession about 576,000 bags, the greater part of which will probably have to be sold overseas.

During the past five or six years the average quantity of maize sold into consumption in the Colony has been in the neighbourhood of 700,000 bags a year. It is possible that the consumption has fallen, but even so, it can hardly be contended that the 92,000 bags sold by the Board in the local market represents seven months' consumption. The truth would seem to be that the exempted maize, which is mainly native-grown, is taking the larger part of the market.

It is stated that millers in the Bulawayo district have been paying 9s. 9d. for native maize, and this would indicate that the consumers are not deriving any benefit from the exemptions. The artificial price which has thus been created for native maize appears definitely detrimental to the ordinary interests of stock-owners and others who are dependent to any extent on native maize for the feeding of their stock, though the enhanced price also undoubtedly benefits the comparatively small number of European producers who sell maize. But their number is small and the total quantity of maize they have available for the market is not very material. It would therefore appear that a considerable injury is being done to the maize industry as a whole without benefit to the consumer and mainly to the benefit of the native producer.

It would, of course, be easy for the Maize Control Board to reduce the level of prices obtainable for exempted maize in Bulawayo by offering maize in that market at a price approximating overseas parity. Sales of a very small quantity at a low price would probably be sufficient to destroy the confidence of buyers and bring the local price to a low level. Such transactions would be actually profitable to the Board, but it has hitherto been considered that they would be detrimental to the traders and producers in the exempted areas, and the Board has therefore maintained its local price in Bulawayo at approximately 10s.

It is now being urged in certain quarters that the Board cannot continue this policy and that the alternatives are either keener competition by the Board to capture the consumer's trade or the cancellation of the exemptions. Various producers' organisations have recently urged that the cancellation of the exemptions would undoubtedly be the better. They recognise that the legitimate interests of the maize growers in the exempted areas are entitled to consideration, and they point out that the Matabeleland producer enjoys a favourable geographical proximity to a large consuming market. The recognition of a geographical advantage is authorised in section 11, sub-section (h) of the Act, and it will be remembered that in respect of the last crop the Board paid a basic price of 6s. 6d. with a geographical advantage of 3d. as between Gadzema and Que Que and 6d. from and including Que Que to the borders of the exempted area. It is considered reasonable that there should be an extension of this geographical advantage if the exemption on the southern side of the Shangani River is removed and it is anticipated that this would probably be in the neighbourhood of 1s. from Shangani to some point intermediate between Shangani and Bulawayo, and thereafter 1s. 6d.

On the basis of last year's output the geographical bonus would give the producer in Bulawayo a basic price of 8s., and it is suggested by the representations made that it would be to his advantage to ensure this bonus rather than to risk a general lowering of prices by competitive action on the part of the Board.

Another point for consideration is provided by the representations made to the Government that Rhodesian maize

should as far as possible be utilised for stock feed and similar purposes in the Colony. It is thought possible that maize for stock feed and actual farm use might, by arrangement with the Control Board, be supplied by the Board at prices materially less than those now obtainable in the open market in the exempted area, thus making the cancellation of the exemption decidedly advantageous to stock-owners and others not directly engaged in the production of maize for sale.

There are, of course, many other aspects which deserve consideration, such as the encouragement given by exemption to evasions of the Act, and to the production of maize in uneconomic areas. Having in view all the circumstances the Honourable the Minister for Mines and Agriculture has arranged to discuss the matter with the producers and stock-owners in the exempted areas of Matabeleland with a view to ascertaining whether the cancellation of the exemptions could be agreed to by mutual consent. The interests of consumers are already protected, since the Control Board is prohibited from selling at a basic price in excess of that authorised by the Government.

HANDBOOK OF TOBACCO DISEASES.

Attention of readers is drawn to the fact that the Department of Agriculture has found it most inconvenient, with the present shortage of staff, to handle the local sales of this book. Arrangements have therefore been made with the Rhodesian Printing and Publishing Company for distribution by them throughout Southern Rhodesia. The book may be obtained from the Herald Store, Salisbury, price 4s., or, postage paid, 4s. 4d.

CLOUDS AND WEATHER IN SOUTHERN RHODESIA.

By N. P. Sellick, M.C., B.Sc., Meteorologist.

Rainfall in temperate climates is associated largely with depressions—the low pressure system has a well-known distribution of weather in its different quarters and travels as a whole, taking the weather with it. While it is possible to detect a diurnal variation in the weather, the principal phenomena are tied definitely to the pressure system.

In Southern Rhodesia conditions are very different. The rainfall is dependent on the general circulation over a very large area, and although travelling pressure systems appear they rarely traverse Southern Rhodesia, and their influence on the weather is to a certain extent indirect and in the form of a modification of the general circulation. The diurnal variation in the weather is very marked, and its influence is often more important than that of travelling disturbances.

It is well known that the prevailing winds in this country swing towards the north in the rainy season and towards the south in the dry season, and more detailed investigation shows that a persistent northerly wind over several days is a forerunner of a spell of rain, and generally that a persistent wind from the south-east spells fine weather. It can be demonstrated that the water content of the air brought by northerly winds is considerably greater than that brought by southerly winds, and that the general rains are of a monsoon character.

The average rate of travel of the air over Southern Rhodesia is comparatively slow, and conditions are normally such that the northerly or southerly air circulations are maintained for considerable periods. Alternating wet and dry periods could reasonably be expected from such a regime,

and in fact this is the case. As a rough approximation, it may be taken that the number of rain days equals the number of dry days during the rainy season: therefore, the chances of rain on any day are equal to the chances of drought. An examination of long period records at Bulawayo and Salisbury shows that the ordinary laws of chance break down beyond this point: on the second and third days the chances are about two to one that the same weather will persist, and after three days the chances rise to three to one at Salisbury and to nearly three to one at Bulawayo for rain and four to one for fine. The ordinary laws of chance need take no account of what has gone before, but the weather of Southern Rhodesia evidently does. The odds quoted above refer to one gauge only, and if account is taken of a reasonable area the persistence of weather is more marked.

It may be accepted that northerly moisture-bearing winds are closely associated with the "rains" in this country. A far more difficult problem is to explain why it rains. A study of the occurrence of rain shows that it may fall at any number of stations in an area from one to all, and that its intensity varies enormously from point to point. If the time at which it falls is taken into account, it is found that a considerable amount of the rain appears to travel. Travelling rain-bands on a large scale are easily distinguished and associated with other phenomena of the weather map, but the majority of smaller bands affecting a few thousand square miles defy analysis with the means at our disposal.

The greater part of the rain appears to occur over large areas at about the same time: it may occur in one area, say the Midlands, between 9 a.m. and noon, in neighbouring areas between noon and 6 p.m., and in more remote areas later. Apart from the general agreement of time, however, there is no evidence of travel; it is as if conditions favourable to rain were developed generally over an area. The occurrence of showers more or less simultaneously over a large area is to be expected if the rain is due to convection, and there is no doubt that scattered thunder showers which occur towards evening after a sunny day are so caused. Unaided convection is quite inadequate as an explanation of the general rains which may last for days under overcast skies without

thunder or lightning, and it is improbable that convection alone can account for the heavy general thunderstorms, which are so common. Surface indications, pressure, wind, temperature and humidity have been examined, but up to the present no important rules have appeared and it remains impossible apart from exceptional cases to venture more than an opinion as to whether continuous rain or heavy or moderate thunderstorms should be expected.

Considerable progress has been made in Europe in the study of cloud in relation to weather and the new International Atlas of Clouds provides for reporting the cloud in great detail. More accurate reports of the height and evolution of cloud are required for the weather service for aviation and as the International code is not designed for tropical conditions it has proved necessary to draw up a code in which special attention is paid to the origin and development of convection clouds.

The preparation of a complete and efficient cloud code is a task of great magnitude and the present International Code is the result of years of labour of a special committee. The code and description of clouds presented in this article has no such authoritative backing, but is based on the experience of a few local observers. It will be used on trial for one or two years and it is hoped that the whole question of weather reports and clouds in the tropics may be brought up for discussion at the next international conference.

The value now placed on cloud observations in Europe is shown by the fact that the space devoted entirely to cloud reports in the ordinary code message has been increased from 2 to 6 figures and it is a reasonable supposition that suitable cloud reports should be of even greater value in the tropics where the weather is largely made on the spot and does not arrive in complete working order from elsewhere.

Cumulus Clouds.—The cumulus cloud is the source of most of the rain in this country and five of the nine numbers in the provisional code have been devoted to its development or degeneration. Of the remaining low clouds recognised, Fr.St. and Fr.Cu. and Nb.St. may give rise to cumulus under favourable conditions. The solution of the problem of the type and amount of rain to be expected under given conditions undoubtedly lies in the upper air, and it is hoped that

more adequate observations of cloud will throw light on the subject.

Thunderstorms can only form when the necessary humidity is present and the fall-off of temperature with altitude is sufficiently rapid.

It is commonly stated that thunderstorms travel against the wind or that they tend to follow features of the ground surface. In actual fact the thunderstorm must of necessity assume the speed and direction of the air in which its bulk lies. It is probable that storms formed on hot, still days may move along paths determined by features of the ground, but the majority of storms may be divided into three classes. First, the line squall, which consists of a chain of storms along the line of contact between approaching cold air and warm air. The line of storms may extend for many miles and travels with the cold air, a single swing of the wind occurs with the passage of the squall and the wind then settles down in the new direction, the temperature falls and remains low. Second, storms may travel in a deep steady current of unstable air. The direction of motion of the storms is then the same as the air and the passage of the storm is associated with a temporary rise in wind velocity, but little or no change of direction; these storms may extend over a wide front.

Third, storms are frequently formed when a thin layer of warm, moist, northerly wind lies under a deep belt of presumably cold air moving from the south. Convection of the warm air carries it into the upper current and thunderstorms are formed in the latter. These storms advance in the direction of the upper wind at velocities as high as 20 miles per hour and their passage is marked by a squall often opposite in direction to the surface wind. The squall is usually succeeded by a period of calm and the original wind returns. The return to the original wind may be as abrupt as the squall, but usually takes place over a period of several hours. The first and third classes occur early and late in the season and the second usually during the general rains.

The definitions and descriptions of clouds which follow are set out in a stereotyped form for the convenience of regular observers, but it is hoped that they may prove of

interest and use to the large body of readers whose livelihood depends on the vagaries of the weather.

DEFINITIONS.

Cirrus (Ci.).—Hairlike.
Stratus (St.).—Sheet or layer.
Cumulus (Cu.).—A heap or lump.
Alto (A.).—High.

Stable.—Remaining without much change for some time.

Convection.—Upward movement due to heat. Clouds which show convection have definite flat bases and high tops; the latter are in a state of motion and change their appearance rapidly. All convective clouds have Cu. in their names.

Fractus (Fr.).—Broken. Many clouds, particularly low, fast moving ones, are ragged and shapeless, and their appearance changes rapidly; these are called fracto.

Drizzle.—Rain falling in the form of numerous very small drops always appearing to criss-cross in the air.

Rain.—Larger drops than drizzle—usually further apart and not criss-crossing in the air.

Shower.—Rain which is directly the result of convection. It only falls from clouds of the cumulus type, is of short duration, and is usually preceded and succeeded by bright skies.

Roman numerals refer to plates in Observers' Handbook, 1926.

CLOUD TYPES—LOW CLOUD (CL.).

CODE NO. 1. CUMULUS (Cu.). XIX. No. 219.

Definition.—Small detached clouds of fleecy appearance with definite bases. Generally unstable and convecting.

These clouds are usually slow moving and high; they appear in the forenoon and are at first few and ragged in shape. If convection is marked, dark flat bases are developed and some of the clouds become very tall, and eventually individual clouds grow into large cumulus (CL2) and the remainder dissolve. They may become very numerous, but cannot cover the whole sky. If convection is insufficient, the

clouds will not grow to any size and will dissolve towards evening or spread out to form stratocumulus (CL4).

Height of Bases.—3,000-6,000 feet.

Weather.—Fair at the time but likely to develop to cumulonimbus and scattered showers if convection proceeds.

CODE NO. 2. CUMULUS AND LARGE CUMULUS.

Definition.—Cu. (CL1) predominating, but some large Cumulus (CL3) in sight.

In the process of development from CL1 to CL3 only a few of the small clouds grow and for a time the sky is dotted with small cumulus, CL1 usually dissolving, and a few large cumulus are visible.

Height of bases and weather are similar to CL1 and CL3.

CODE NO. 3. CUMULUS (LARGE AND SWELLING). (Cu.).
XXI. No. 221.

Definition.—Thick clouds with great vertical development; the upper surface is dome-shaped and lumpy (cauliflower), while the base is nearly horizontal and dark.

This cloud usually forms on hot, calm, sultry days, but may appear in cool weather after the break-up of Fr.St. and Fr.Cu. (CL6).

Large cumulus is only recognisable as a whole at a distance of a mile or more, when the edges and base appear hard and clear; when overhead or nearly overhead the base covers an appreciable area of the sky.

Large cumulus may form as an individual cloud in a blue sky as a process of steady growth or as a later stage of Cu. (CL1). More frequently during the general rains it forms after the break-up of layers of A.St. (C1 and 2) and Fr.St. (CL6) and Nb.St. (CL8).

Large cumulus may degenerate into stratocumulus by spreading out at any level accompanied by the disappearance of the remainder of the cloud.

Height of Base.—2,000 to 4,000 feet.

Weather.—Light showers may fall from large cumulus, but until the ragged top and black base of cumulonimbus (CL7) is formed no appreciable rain is likely.

CODE NO. 4. STRATOCUMULUS (St.Cu.) XXV. No. 218.

Definition.—A layer of greyish cloud with wavy, but clearly defined base generally showing regular streaks or patches of light and dark, sometimes with blue sky showing through.

Stratocumulus is never very low and is fairly stable. It rarely gives rise to rain, but may form from stratus (CL6) or nimbostratus (CL8) after rain and drizzle.

Stratocumulus (CL4) should not be confused with the patches of stratocumulus (CL5) formed from cumulus.

Height.—1,000-5,000 feet or more.

Weather.—Usually fair, but dull.

CODE NO. 5. STRATOCUMULUS AND CUMULUS.

Definition.—Patches of stratiform cloud formed by the spreading out of cumulus and usually associated with cumulus.

This is usually an evening cloud, but it represents the break-down of convection; it may take place at any stage in the formation of cumulus. It may form from cumulus (CL1) or large cumulus (CL3) or later cumulonimbus (CL7).

It may be distinguished from ordinary stratocumulus (CL4) by the fact that it is always preceded by convection.

Height.—2,000 feet up to lower limit of Altocumulus.

Weather.—Sometimes hot and fair or cool after thunder showers.

Note.—Stratocumulus may form along the base line between cumulonimbus clouds joining the bases to form a continuous layer covering the whole sky. This type should be coded Cu.Nb. (CL7), not CL4, 5 or 8.

CODE NO. 6. FRACTOCUMULUS OR FRACTOSTRATUS (Fr.Cu., Fr.St.). XVI., XVII., XX.

Definition.—Low ragged fast-moving clouds with ill-defined edges in a constant state of change and turmoil.

Fractostratus is quite shapeless, but fractocumulus approximates to cumulus in appearance.

The appearance of the sky changes very rapidly with this type of cloud, it may appear in the morning often under

altostratus or altocumulus and increase rapidly until the whole sky is covered and then break up again, fragments developing into cumulus (CL1 and 3). On occasion the sky is covered or nearly covered in the early morning and the cloud sheet rises and breaks up within a few hours of sunrise. The break-up of a cloud sheet of this type is usually followed by the formation of cumulus.

Height.—Surface to 2,000 feet.

Weather.—Cool, windy and damp, drizzle only occurs with this cloud.

CODE NO. 7. CUMULONIMBUS (Cu.Nb.). XXII., XXIII.

Definition.—Cumulus clouds with very dark bases and great vertical development in which the tops have lost their rounded appearance and are windswept and ragged. Fractostratus may be present below, or in front of the main cloud in the form of a roller or arch and the base may be ragged and misty.

The base is large and may appear to cover the whole sky when the cloud is overhead and its passage is almost invariably associated with heavy showers of rain, thunder, windsqualls and a fall in temperature, and sometimes hail.

Cumulonimbus is a regular factory of clouds; the sky in the rear usually shows a great confusion of stratiform clouds from cirrus to stratocumulus (C5).

Height.—Clearcut bases are rarely below 1,500 feet, but the ragged and misty bases, and the fractostratus may descend to ground level.

Weather.—Heavy rain storms, squalls and occasionally hail.

Note.—When cumulonimbus is overhead the base has an appearance similar to Nimbostratus (CL8); the two cases may be distinguished by the convection preceding and the thunder and squall accompanying cumulonimbis.

CODE NO. 8. NIMBOSTRATUS (Nb.St.).

Definition.—A low, dark layer of fractostratus associated with thick altostratus (C2) and accompanied by driving rain.

The low cloud is in a continuous state of agitation and frequently breaks and brighter patches appear where the altostratus shows through. The base is always ill defined and misty.

Height.—Surface to 2,000 feet.

Weather.—Cool and windy with rain. No sunshine.

CODE NO. 9.

Definition.—A bank of low cloud on the horizon only, and not recognisable.

MEDIUM AND HIGH CLOUD (C.).

CODE NO. 1. ALTOSTRATUS, THIN (A.St.). XXVI.

Definition.—A sheet of grey or bluish colour through which the sun shows faintly.

CODE NO. 2. ALTOSTRATUS, THICK (A.St.).

Definition.—A dense sheet of grey or bluish colour which obscures the sun.

This cloud is associated with lower clouds and may occasionally give rise to rain.

CODE NO. 3. ALTOCUMULUS AND HIGH STRATOCUMULUS. XXVII.

Definition.—A layer of white or greyish cloud broken-up into a pattern by lines. The base shows definite shading.

The pattern of altocumulus is usually regular, but it sometimes has the appearance of crazy paving, and at times appears in the form of broad parallel bands.

CODE NO. 4. ALTOCUMULUS AND ALTOSTRATUS.

Definition.—Altocumulus and altostratus together in the sky. These clouds are frequently seen together at the same or different levels.

CODE NO. 5. ALTOCUMULUS AT DIFFERENT LEVELS.

Definition.—Altocumulus and Altostratus at various levels associated with thick fibrous veils and a confused appearance of the sky. This type of sky cannot be described in detail, but is easily recognisable and is characteristic of thundery weather.

Code No. 7. Cirrus Densus.

Definition.—A thick whitish veil formed from the top of Cu.Nb. This cloud is frequently seen towards evening and in the early morning, always after thunderstorms.

Code No. 8. Cirrus (Ci.). XXVIII., XXXI.

Definition.—Delicate patches of cloud scattered over the sky sometimes in the form of hooks ending in a tuft.

These clouds are high and usually appear to move slowly from the west.

Code No. 9. Cirrostratus (Ci.St.). XXXII.

Definition.—A thin pearly white sheet which does not obscure the sun.

Halo phenomena are always observed when Ci.St. passes across the sun.

Note.—In many cases a variety of cloud forms will be visible and it will be necessary to disregard some forms in selecting code figures. In this event always select the predominating form for report.

A.I.V. SILAGE.

[*Memorandum Prepared and Circulated by the Imperial Bureau of Animal Nutrition, Aberdeen.*]

In the conservation of the luxuriant summer production of green fodder for as winter food for live stock, one of the most important considerations is that the process should ensure the maximum retention of the original nutritive qualities of the material preserved. Hay made under ideal weather conditions is an excellent food, but the unreliable climate and comparatively high rainfall of northern European countries render it doubtful whether grass can be preserved in this way without loss of much less than 50 per cent. of its original nutrients. Consequently, investigation has been made into alternative methods, the most economical of which have been the preservation of grass in the form of silage. Numerous and sufficiently well-known variants of this principle are practised, but most of them involve a certain loss in the nutritive value of the original material.

In a country like Finland, where the summers are short, the provision of adequate supplies of nutritious winter food is of prime importance. In 1925, Dr. Artturi I. Virtanen, Director of the Research Laboratory of Valio, the large Finnish Co-operative Dairy Organisation, began an investigation into the preservation of grass in the form of silage, and he has now devised a technique by which he claims a conservation without fermentation and with all but an insignificant loss. To this process the name A.I.V. silage has been given, derived from the initials of the inventor. As the relative literature is scattered and mostly in the Finnish language, the purpose of this note is to summarise for the benefit of numerous enquirers the existing information on the process.

Theoretical Basis of Method.—Virtanen started from the assumption that the conservation of green forage without

noticeable loss is possible only when the splitting up of the nitrogenous material in the green forage by proteolytic enzymes is completely prevented. He had already observed that neither in the cells of higher plants nor in bacterial organisms themselves did there occur proteolytic enzymes capable of acting at a pH* index lower than 4. If, therefore, the degree of acidity in the green fodder is brought down below pH 4 in the conserving process, the breaking down of the nitrogenous substances is prevented. In laboratory experiments it was shown that acids such as hydrochloric acid, sulphuric acid, phosphoric acid, lactic acid, etc., could be homogenously mixed with the fodder, and that by this means the pH value of the mass could be kept below 4 when once it had been reduced to that figure. Since much larger quantities of weak organic acids than of strong mineral acids are required to obtain the same pH index, it became apparent that in practice the principal mineral acids would be most suitable. Laboratory trials proved that food preserved with hydrochloric acid was highly satisfactory from the bacteriological point of view, in that no development of coli and butyric acid bacteria took place.

It is the attainment of the correct pH value by the addition of acid which constitutes the essential feature of the method. Though it is generally accepted that hydrochloric acid is the acid which plays the chief part in the process, practical considerations have led to the use of a mixture of acids, the exact composition of which is not known. This solution is termed the "A.I.V. solution." The next step was to subject the method to practical tests on the basis of the laboratory experiments.

Application of the Method in Practice.—The standard type of A.I.V. silo is circular in shape, 16½ feet in diameter and 5 feet deep. A smaller type, 3 metres in diameter, is recommended on farms having less than 15 milk cows. The pit is dug somewhat wider than 5 metres, to facilitate the construction of the cylindrical wall of planks, after which any empty space outside the wall is filled in with earth and

* The pH index is used to indicate the degree of acidity in soils or other material. A neutral condition is indicated by pH 7, while maximum alkalinity is represented by pH 10. The lower the pH value the greater the acidity.—(Editor.)

stamped down. Sites free from sub-soil water, on rising ground, near the farmyard or crop to be ensiled, are generally selected. The bottom of the silo pit is levelled, and where the soil is clayey, spread with a layer of clean gravel. No floor boards are used. Where possible, a drain pipe should be laid from the centre in order to carry off the sour liquid which collects after the pit has been filled. If, owing to the presence of sub-soil water, the pit cannot be made deep enough, the walls may project above the ground, in which case earth must be banked up outside and covered with sods. If necessary, the silo can be erected entirely above ground and the wall of the earth and sods piled up correspondingly high.

When finished, the pit is filled with fresh fodder (chopping up is unnecessary), spread as evenly as possible in lots of about 450 lbs. at a time, and sprinkled with the A.I.V. liquid, which is measured out accurately in accordance with the directions supplied. This solution is poured from watering cans which have been previously coated inside with varnish or rubber. Each successive lot of 450 lbs. is tramped down as evenly as possible, rubber boots being worn in preference to leather, as the liquid gradually destroys the latter. When the pit is quite full, a closely fitting circular upper section, constructed of planks 6½ feet long, is placed in position, and the filling up proceeds as before until this upper section is also full to the brim. Clean boards are then placed on top in the form of a lid, which is then weighted down with heavy stones or sandbags. The whole is left to settle for one night, after which the weights and boards are removed and the silo once again filled to the brim. The top layer of fodder, especially near the edges of the silo, is sprinkled with a fluid called "Mildew Death," which prevents the formation of mould. The silo is now ready to be covered in.

In covering, the object is to press down the material in the section above ground until its upper surface is level with the edge of the pit. Experience has shown that if the foregoing measurements and instructions are observed, this will be achieved by the pressure of a layer of clay 1½ feet deep. The procedure is as follows: Over the green mass a layer of newspapers is first spread, followed by a layer of wet

sawdust or peat mould 4 inches thick. In autumn, the latter may be replaced by beet leaves, in which case newspapers are not necessary. On the top of the sawdust (or beet leaves) is placed a layer of earth 20 inches deep, which is well trodden down and smoothed over. In the course of three days the green mass will have sunk down level with the top of the pit. The upper section, which is now empty except for the layer of earth, is removed—a matter of no difficulty, as it is constructed of six or eight separate pieces which are easily erected and dismantled. Its final form is that of a flattish cone, so that rain water will easily run off. Finally, it is covered with straw held down with planks or brushwood, which serves as a protection against extremes of weather. The pit remains thus until its contents are needed.

Concrete towers may also be used. These are usually 25 feet high by 16½ feet in diameter, and have a hole in the side through which the food is removed. The method of filling is the same as for the pits, but no newspapers, sawdust or earth need be employed as covering material. The top is covered with a wooden cover on which stones to the weight of 500 to 600 lbs. per 10 square feet are placed, and the silo is roofed over when full. Concrete silos are usually built close to farm buildings, while the pits are generally dug in the fields at appropriate points, the food being carted in when required.

The food is ready after the lapse of about two months, and practically no loss of nutritive value is found to have taken place. Certain factors may, of course, cause failure. Water collecting at the bottom of the pit may injure the silage in varying degrees, in some cases entirely spoiling it. If the mass is not sufficiently tramped down, or if too little earth is spread on the top of the finished silo, air may penetrate, thus giving rise to the formation of moulds, which cause protein breakdown and alteration of the pH index. Material which is not quite fresh at filling may also cause mould formation. The correct addition of the A.I.V. liquid is another source of trouble, but with care and precision the preparation of the silage is reported to be easy and satisfactory. The silage should be removed from the pits in layers and not in blocks, and each time food is removed the pit should be re-covered with sacking and straw as a protection against frost.

The A.I.V. Liquid, and the Solution known as "Mildew Death."—The liquid supplied by the Valio laboratory is diluted before use; 1¾ pints of liquid is added to 5¼ pints of water. The quantity to be applied is varied according to the character of the green forage employed. It is stated that the quantities used for 200 lbs. of green forage are the following:—

For clover and other leguminous crops ...	12 lbs.
For grasses	10 ,,
For clover grass mixtures	11 ,,
For kale and root-crop leaves	8 ,,

The quantities are for material of normal moisture content, but it is recommended that they be increased by 1 lb. per 200 lbs. of green material if the weather is very dry when the crops are being carted. The composition of the acid solution to be added to the forage presents no scientific secret, for, according to Virtanen, it is a matter of complete indifference what kind of acid innocuous to animals is used. It was only practical reasons which led Virtanen to use an acid mixture in which the principal constituent is hydrochloric acid. To achieve success, it is absolutely necessary to ensure that a definite quantity of this chemical solution comes in contact with a definite quantity of the forage to be preserved. Any alteration in the prescribed amounts will not give the desired result.

Close attention must be given to the prevention of the growth of moulds which form one of the chief causes of failure. This is most liable to occur in the top layers of the ensiled mass, where the access of air is easiest. In the search for a specific against mould, Virtanen proceeded from the observation that A.I.V. feeds prepared from cabbage tops do not as a rule become mouldy even when the silo pit was imperfectly covered and admitted a certain amount of air. From this he inferred that crucifers contain a substance toxic to mildew. This assumption proved to be correct, inasmuch as the mustard oil found in the cruciferæ was very effective against mould even in high dilution. Using a solution containing 0.001 per cent. of allyl mustard oil, no moulds occurred. This substance Virtanen has named "Homesurma," or "Mildew Death," and in a pit or elevator 16½ feet in diameter one-third of an ounce of "Homesurma"

is sufficient to protect the surface of the feed. Tests undertaken to ascertain whether "Homesurma" was harmful to animals showed that high amounts fed to a cow daily for two weeks produced no ill effects.

Choice of Raw Material for Ensilage.—Attention has been given by the users of the process to the type of raw material which is most suited to this method of ensilage and what green crop is economically the most advisable to cultivate.

One must choose plants which have a luxuriant foliage and yield heavy crops, and the green material must be sufficiently juicy so as to facilitate pressure into compact masses. Leguminous crops which naturally have a high nitrogen content are the most important. Feeding-peas and vetches are of this nature, but suffer from the disadvantage that they are weak in the stem, and hence are usually sown with some supporting crop such as oats or other cereal. These latter, however, are not entirely suitable for A.I.V. fodder owing to their encouraging the formation of mould during the process of conservation. In Great Britain and Central Europe the horse bean (*Vicia faba*, L.) has been found to provide a satisfactory support to vetches and peas, and an excellent A.I.V. fodder which is readily eaten both by horses and cows is obtained therefrom. Pastures in which clover thrives come next in importance. Cuts should be made as early as possible, preferably just before the clover flower bud is formed. Flowering Timothy grass is not recommended as a basis for A.I.V. feed. In Finland, the cultivation of rye crops for silage appears to be gaining favour. Many other green crops have been used, among which kale has been found very advantageous. The lower portions of the kale stem to a height of some 4 inches are quite valueless as food, however; therefore, kale should be harvested by a machine and not pulled up by the roots.

Characteristics: Composition: Practical Feeding Tests.—A.I.V. fodder is readily consumed by animals. When ready it is rather moist and has a sweet and slightly acid taste. The odour is agreeable, and it is stated that cattle will take it in preference to turnips if offered a choice. Analyses of numerous samples of A.I.V. feed have been made, and it is claimed that food preserved in this way does not suffer any

material loss of nutritive value. The accompanying table, compiled from Virtanen's own data, shows a comparison between the protein content of fresh Timothy grass and that of A.I.V. silage prepared from Timothy grass.

	Fresh Timothy Grass (Av. 6 Samples).	A.I.V. Silage from: Timothy Grass (Av. 12 Samples).	A.I.V. Silage from: Clover Aftermath (Av. 3 Samples).
	%	%	%
Dry matter	21.8	21.0	23.6
Crude protein in dry matter	14.8	14.6	17.2
True protein—			
% In crude protein ...	84.3	82.5	88.0
% In dry matter	12.4	12.0	15.1
Soluble albumen—			
% In true protein ...	50.3	50.5	69.0
% In dry matter	6.2	6.0	10.4

According to these figures the true protein of fresh Timothy grass amounts to 84 per cent. of the crude protein. In the A.I.V. Timothy fodder the corresponding figure is 82.5, thus showing that little decomposition of protein substance takes place in the A.I.V. treatment. The proportion of soluble albumen in the true protein is the same for the fresh as for the ensiled grass—namely, 50 per cent. In A.I.V. feed prepared from clover, the true protein averages 88 per cent. of the crude protein and the soluble albumen 69 per cent. of the true protein. Though corresponding figures for fresh clover are not quoted in the literature, these values are, according to Virtanen, the same as are found for fresh clover. It must be noted that from the published analytical data it is not clear whether the analysis of fresh Timothy grass was made on samples from the same crop as was ensiled and subsequently analysed after treatment, or whether the fresh grass figures refer to some different crop from that ensiled.

In feeding experiments it has been possible, by using A.I.V. to the extent of 50-60 per cent. of the food required, to reduce the usual amount of oil-cake by one-half and still maintain an unchanged milk yield. Even more advantageous results can be obtained by using the feed at the rate of 70-90 per cent. of the total food, particularly if silage prepared from clover or clover-rich grass is used. In Table II., the

yield of four groups of cows at the same stage of lactation and on A.I.V. feeding is compared with four similar groups on ordinary feeding.

	Food Consumed: Oatmeal, Kg.	Oil-cake, Kg.	Milk Yield, Kg.
A.I.V. Silage Groups—			
Group I. (4 cows) ...	400.3	266.9	4,837.3
Group II. (2 cows) ...	147.8	165.2	1,955.0
Group III. (2 cows) ...	203.7	203.7	2,664.0
Group IV. (2 cows) ...	232.6	232.5	2,860.2
Total	984.4	868.3	12,316.5

	Food Consumed: Oatmeal and Bran, Kg.	Oil-cake, Kg.	Milk Yield, Kg.
Hay-Turnip Groups—			
Group I. (4 cows) ...	712.5	970.1	4,707.3
Group II. (2 cows) ...	385.0	429.0	1,884.2
Group III. (2 cows) ...	460.0	247.0	2,412.0
Group IV. (2 cows) ...	362.6	362.6	2,496.1
Total	1,920.1	2,008.7	11,499.6

In the A.I.V.-fed groups, there has thus been an increased milk yield of about 7 per cent. Furthermore, this has been achieved by the use of 56 per cent. less oil-cake and 48 per cent. less oatmeal (and bran) than in the normal groups.

In general, it appears that about 90 lbs. A.I.V. fodder is considered the normal daily ration for milk cows of average yield. No digestive disturbances have been observed. A few examples of the results of feeding tests made on holdings where the live stock dietary was based on A.I.V. fodder are given below:—

(a) Anola Estate.—Two hundred cows fed a daily ration of 90 lbs. A.I.V. silage (Timothy and clover), 5lbs. concentrates (oatmeal and Soya bean meal), 5½ lbs. hay (inferior quality) and 9 lbs. oat straw gave an average milk yield of 36 lbs. per day.

(b) Patiala Estate.—Twenty-five cows fed a daily ration of 90 lbs. A.I.V. silage, 5½ lbs. hay, 13 lbs. skim milk and 9 lbs. oat straw gave an average milk yield of 36 lbs. per day.

(c) An Ayrshire cow fed for 43 days before calving with 70 lbs. A.I.V. silage, 3½ lbs. straw and 6½ lbs. hay gave after calving an average of 35 lbs. milk per day for 51 days on an average ration of 6½ lbs. hay and 84 lbs. A.I.V. silage with no concentrates. The yield progressively increased from 32 lbs. at the beginning to 44 lbs. per day at the end of the period.

(d) A cow fed all the year round with about 5½ lbs. hay and 90 lbs. A.I.V. silage per day, together with pasturage for 3 months in the summer, and no concentrates whatever, gave a milk yield of 900 gallons during one lactation period.

Cost.—The cost per food unit of preparing A.I.V. silage is reported to be about equal to or rather less than the cost of hay-making. In one case, the cost of preparing 640 tons worked out at 3.1 man-hours and 3.5 horse-hours per ton of fodder. Calculated from Finnish currency at par rate of exchange, the equivalent working cost in sterling is about one-fifth of a penny per food unit. To this must be added the cost of growing the green crop and the cost of constructing the silo, which brings the total cost in the byre to about three farthings per food unit. The cost of building concrete towers and pit silos is relatively small, being for the former about £70 and for the latter about £5. These are the equivalent par sterling values of costs given in Finnish currency.

Costings made on one farm showed that by using A.I.V. fodder the cost of butter-fat production was reduced by 30 per cent.

Effects on Animals and Animal Products.—Fears have been entertained that A.I.V. fodder may react unfavourably on the metabolism of lime and phosphorus. Those qualified to speak, however, state that there are no grounds for this supposition, as after intensive tests of three years' duration no disturbance of mineral metabolism was noted. The ash

of this fodder has a basic reaction, but one can further safeguard against acidity by adding a neutralising salt—in fact. Virtanen recommends that chalk and sodium carbonate should always be given along with A.I.V. To 60 lbs. of the feed, 2 *ounces* of *chalk* and 1 *ounce* of *sodium carbonate* is sufficient.

Large-scale tests by the Valio concern show that the state of health of cows fed on A.I.V. feed was particularly good. In some few cases where the fodder used had been very much cooled down, it caused chills and digestive disturbances.

The milk from cows fed on A.I.V. silage is said not to have the peculiar taste which occasionally results from the use of other types of pressed fodder, and many users of ordinary silage have changed over to the A.I.V. product for this reason. Butter has the rich yellow colour of summer butter, indicating that nothing is lost by this new method of preparing fodder. The consistency of the fat is the same in winter as in summer, whilst the crumbly texture typical of winter butter is eliminated. The only cheese that cannot be made from the milk of A.I.V.-fed cows is Emmenthaler, and researches are in progress to determine why this should be so. On the other hand, the milk is well adapted for the more acid cheeses such as Edamer, etc.

Extent Practised: Patents.—Thanks to the enterprise of the Valio Co-operative Dairy Concern, the method has been intensively developed in Finland, and is apparently in widespread use in that country. The results obtained were so good that some 70,000 tons of A.I.V. ensilage were prepared in Finland in 1930. The measures adopted by Valio to promote interest in the process consist of lectures, advisory work, field demonstration, etc., and in all 12,000 persons received instruction in the preparation of A.I.V. fodder during 1930. Instructional tours were extended to countries outside Finland, and the claims made for the process are being investigated in Denmark, Sweden and Germany. A certain amount of criticism of the process has been forthcoming from these countries, of which mention must be made. One aspect of this has been to ascertain the import of Finnish claims to patent rights. The basic principle in the new method of conservation has been protected in the most

important cattle rearing countries by a patent applied for in the name of Virtanen and the Valio Co-operative Export Association. It appears that some objection has been made to the granting of patent rights on the grounds that the principle on which the method is based is not new. Virtanen admits that patent protection is not usually sought for discoveries relating to agricultural method, but takes the standpoint that possession of a patent gives impetus to the new enterprise. It stimulates the investment of money, and facilitates the promotion of advisory propaganda. If, for example, anyone in Finland were free to sell acids for the preparation of A.I.V. fodder, no effective instructional work could be carried on in the face of competition, and the method would certainly fall into disrepute owing to faulty application.

Interest in Method in Sweden, Denmark and Germany.—In the latter part of 1931, considerable discussion took place in the columns of the Swedish agricultural Press regarding the application of the Finnish A.I.V. method in Sweden. Controversy between Swedish agricultural authorities and Dr. Virtanen centred round the validity of the Finnish patent claims, it being pointed out that priority in the discovery of the use of hydrochloric acid for regulating the action of proteolytic enzymes belongs to Germany and not to Finland. Attempts to circumvent the patent were made by making slight alterations in the A.I.V. technique, and extensive investigations were carried out by Swedish agricultural authorities on a method described as "similar" in the main to the Finnish method. The essential difference in the Swedish method lay in composition of the preservative solution, which consisted of molasses mixed with a small amount of hydrochloric acid and a little sulphuric acid. The amount of acid added is insufficient to stop fermentive processes, and the object of adding molasses is to hasten the formation of lactic acid which otherwise takes place gradually at the expense of the plant carbohydrate stores. This procedure is different from the A.I.V. method, and it is thereby asserted that the patent claims of Virtanen are not transgressed. Virtanen eliminates enzyme action and makes an unfermented silage; the Swedish method regulates the biochemical changes and seeks to produce a fermented silage of good quality from the standpoint of dairy technique.

Apparently, however, the controversy has ended satisfactorily, as an agreement has been made between Dr. Virtanen and the Valio Co-operative Society in Finland on the one hand and the National Association of Swedish Farmers on the other whereby the A.I.V. patent rights have been acquired for Sweden. Presumably, therefore, the A.I.V. method will supersede the molasses method.

In Denmark, ensiling grass has not hitherto been widely practised, it being regarded as a risky method of preserving forage, very often involving heavy loss in the destruction of valuable quantities of food. Consequently, the claims made for Virtanen's method are being studied with much interest there. In Denmark, too, priority claims are not lacking. Mr. N. T. Pederson, a Danish State Agricultural Expert, writes that he had made ensilage with hydrochloric acid some seven or eight years before Virtanen. The method was as follows: To the fresh green material (kohlrabi leaves), 5 per cent. of a 2 N or 3 N solution of hydrochloric acid was added. Subsequently, an addition of molasses was made to ensure a rapid formation of lactic acid. The principle here is apparently similar to that involved in the Swedish method noted above.

A close study of the A.I.V. method has been made in Germany. To German science, according to Münzberg, the Finnish method offers but little that is new. In Germany, Fingerling has been working since 1925 on the question of conserving green food with the aid of acids, and his applications for patents received early recognition. The Fingerling method is also characterised by conservation through the addition of hydrochloric acid in order to keep the hydrogen concentration below pH 4. Early in 1926, Fingerling reported the results of his experiments to the German Agricultural Society and gave a preliminary account of a test made by Gorlach and Richardson, the outcome of which was that it would be premature to make known the details of the method before further investigation. Trials of the same nature by Wöhlbler are reported to have yielded very good results, showing that by the use of hydrochloric acid beans, clover grass, clover, vetches and other leguminous crops could be advantageously ensiled without any loss of nutritive value whatever, provided the pH index 4 was not exceeded.

At the annual meeting of the German Food Conservation Association held in Berlin in February, 1932, mention was made of the impetus which had been given to the silo movement in Germany by the reports of the A.I.V. method reaching Germany from Finland. Methods analogous to the A.I.V. are being practised in many and widely separated districts in Germany, and are reported to be giving brilliant results. Silage preserved with hydrochloric acid was readily taken by animals and agreed excellently with them, no trace of the added acid being found in the food.

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RE-NAMING OF SPANISH BUNCH GROUND NUTS.

For a considerable time there has been doubt as to whether the variety of ground nut popularly known as Spanish bunch in Rhodesia was correctly named. A few years ago samples of certain Rhodesian varieties were forwarded to the Division of Plant Industry, Union Department of Agriculture, for trial and comparison with types commonly grown in South Africa. It was found that the variety known in this Colony as Spanish bunch was in the Union termed Virginia bunch, and in order to obtain a ruling on the matter samples of various types were forwarded to the United States Department of Agriculture for identification.

We are now informed by the Division of Plant Industry of the Union, that the Virginia bunch nut of Rhodesia conforms in all respects to the type known under that name in the United States of America, but that our Spanish bunch is not correctly named, since it is in all essentials identical with a variety known as "Valencia" in America, and widely recognised under that name in the trade.

The Union Government has recently introduced grading regulations for the class of ground nut which we in Rhodesia, until now, have always called Spanish bunch. The nomenclature adopted in these Union regulations is "Valencia" or "South African Virginia Bunch." This particular nut appears to be finding a good deal of favour on the overseas market, in the form of graded nuts in the shell for the street-barrow trade, and it seems desirable firstly that the African product should be marketed under a name by which it is already well known, and secondly that as near as possible the same name should be applied to both South African and Rhodesian nuts of this type.

The variety known in other parts of the world as Spanish bunch is not grown in this Colony, and it is therefore recommended that this name should be dropped and that the nut which it has hitherto described should for the future be known and classified among growers and exporters as "Rhodesian Valencia."

SOUTHERN RHODESIA GROUND-NUTS.

REPORT BY IMPERIAL INSTITUTE, SOUTH KENSINGTON, LONDON.

The nine samples of ground-nuts which are the subject of this report were forwarded to the Imperial Institute by the Chief, Division of Plant Industry, Southern Rhodesia.

The samples were stated to represent shelled and unshelled ground-nuts of types which could be made available in large quantities for export. It was desired that their quality and value should be ascertained, with special reference to the relative popularity of each type, the extent of the market for which each is suitable, the average price which it might normally be expected to realise, and the type of ground-nuts from foreign countries with which it would compete. Confirmation was also desired of certain details of the market requirements for ground-nuts required for various purposes (*e.g.* oil-crushing, the street barrow trade, the salted nut and confectionery trades) and the points raised in this connection are dealt with in the present report.

Description.

The samples, which weighed from $\frac{3}{4}$ to 1 lb. each, were as follows:—

No. 1 *Rhodesian Valencia* (Spanish Bunch).—Ground-nuts in shell, in good, unbroken condition. The shells were covered with a film of reddish-brown earth. The size of the nuts varied from $1\frac{3}{8}$ in. long by $\frac{1}{2}$ in. in diameter to 2 in. long by $\frac{1}{2}$ in. in diameter, being mostly $1\frac{1}{2}$ in. long by $\frac{1}{2}$ in. in diameter. The nuts contained mostly three kernels, but some had two and others four. The kernels varied from small to large, being chiefly of medium size and were plump, with deep pink skins; in some cases the skins were pinkish brown.

No. 2 *Rhodesian Valencia* (Spanish Bunch) *Washed in sand.* Ground-nuts in shell, in good, unbroken condition, similar to those of sample No. 1, but almost entirely free from reddish-brown earth.

No. 3 *Rhodesian Valencia* (Spanish Bunch) *Kernels.*—Small to medium-sized, plump, kernels with skins of a deep pink colour, but *not of quite so deep a tint* as the kernels of sample No. 1.

No. 4, *Masumbika.*—Ground-nuts in shell, in good unbroken condition. The shells were not of quite such good colour as those in sample No. 2. The nuts varied in size from $1\frac{3}{8}$ in. long by $\frac{5}{8}$ in. in diameter to $2\frac{1}{4}$ in. long by $\frac{5}{8}$ in. in diameter, being mostly $1\frac{1}{2}$-2 in. long by $\frac{5}{8}$ in. in diameter. They contained either two or three kernels. The kernels were large, plump, with pale pinkish-brown skins, in many cases showing brown spots.

No. 5, *Masumbika Kernels.*—Large, plump, with pale pinkish-brown skins; similar to those of sample No. 4.

No. 6, *Virginia Bunch.*—Ground-nuts in shell, in good, unbroken condition. The shells were not of such good colour as those of sample No. 4. The nuts varied in size from $1\frac{3}{8}$ in. long by $\frac{5}{8}$ in. in diameter to 2 in. long by $\frac{3}{4}$ in. in diameter, being mostly $1\frac{1}{2}$ in. long by $\frac{5}{8}$ in. in diameter. The nuts nearly all contained only two kernels. The kernels were large and on the whole plump, with pinkish-brown skins.

No. 7, *Virginia Bunch Kernels.*—Large, plump, pinkish-brown and similar to those of sample No. 6.

No. 8, *Jumbo.*—Ground-nuts in shell, in good, unbroken condition. The shells were reddish-brown owing to the presence of earth. The nuts varied in size from $1\frac{1}{2}$ in. long by $\frac{5}{8}$ in. in diameter to $2\frac{1}{4}$ in. long by $\frac{3}{4}$ in. in diameter, being mostly $1\frac{5}{8}$ in. long by $\frac{5}{8}$ in. in diameter. Most of the nuts contained only two kernels. The kernels were large and plump, with pinkish-brown skins.

No. 9, *Jumbo Kernels.*—Large, plump, with pinkish-brown skins and similar to those of sample No. 8.

Results of Examination.

Samples No. 1 (Rhodesian Valencia), No. 4 (Masumbika), No. 6 (Virginia Bunch) and No. 8 (Jumbo) were examined in detail with the following results:—

	No. 1 Rhodesian Valencia.	No. 4 Masumbika.	No. 6 Virginia Bunch.	No. 8 Jumbo.
Average weight of nuts in grams	1.8	3.2	2.5	2.9
Average weight of kernels, in grams	0.45	0.86	0.90	1.02
Shell, per cent.	24.1	29.9	28.7	30.5
Kernels, per cent.	75.9	70.1	71.3	69.5
Oil in entire nuts, per cent. ...	34.2	30.6	31.4	30.6
Moisture in kernels, per cent.	5.4	5.7	5.7	5.8
Oil in kernels as received, per cent.	45.1	43.6	44.1	44.0
Oil in moisture-free kernels, per cent.	47.7	46.2	46.8	46.7
Acid value of extracted oil ...	0.3	0.3	0.7	0.9
equivalent to free fatty acids (expressed oleic acid), per cent.	0.15	0.15	0.35	0.45

These results show that the four varieties, as represented by the samples examined, contain normal amounts of oil, and would be suitable for crushing, although the Masumbika, Virginia Bunch and Jumbo nuts have a rather high percentage of shell. The acidity of the extracted oils was in each case satisfactorily low.

Commercial Value.

(A) The ground-nuts were submitted for valuation to a firm of merchants in London, who stated that they had recently been approached by the High Commissioner for Southern Rhodesia with reference to the Masumbika variety and had received from him samples of (a) large, and (b) medium kernels. They further mentioned that they had received notification that a much larger supply of ground-nuts was expected this year from South Africa than was

shipped last year and expressed the view that the arrival of this increased quantity from the Union might cause the prices of South African ground-nuts to fall appreciably. The firm offered the following observations on the present samples:—

No. 1 *Rhodesian Valencia in Shell.*—The colour of the shells of these nuts is not suitable for the barrow trade, but the nuts would be saleable in certain circumstances, *e.g.*, when supplies of other and better kinds were short.

No. 2 *Rhodesian Valencia in Shell, Washed in Sand.*—This is the best of the four samples of ground-nuts in shell, and is currently worth 33s.-35s. per cwt. spot, ex wharf, as compared with Chinese new crop hand-picked selected nuts in shell at 13s.-14s. per cwt. c.i.f. This high value of the nuts is due both to their superior quality and to the limited supply at present available.

Nos. 4, 6 *and* 8, *Masumbika, Virgina Bunch and Jumbo, in Shell.*—In the present state of the market it is not advisable to ship these varieties in shell.

No. 3 *Rhodesin Valencia Kernels.*—These kernels, whilst somewhat inferior to Spanish-grown kernels of this variety, are about equal to those exported from South Africa. The current value is 25s. per cwt. spot. It is essential that the quality of such kernels should be maintained in all shipments.

Nos. 5, 7 *and* 9, *Masumbika, Virginia Bunch and Jumbo Kernels.*—These kernels, like the samples of large and medium Masumbika kernels recently sent to the firm by the High Commissioner for Southern Rhodesia, would realise from 1s. to 2s. per cwt. more than Chinese hand-picked selected kernels, which are quoted at 17s. per cwt. c.i.f. (October-November) and are being offered by sellers at 14s. per cwt. for November-December. Of the three samples of kernels concerned, the large Masumbika kind would have a slight preference on the market.

The above remarks indicate the relative popularity of the different varieties, but the firm in question stated that it is not possible to estimate the actual extent of the market

for which each kind is suitable. "Normal" prices cannot be supplied, as there is no such thing as normality in this trade.

(B) The samples of ground-nuts in shell, Nos. 1, 4, 6 and 8, were also submitted to a second firm. This firm forwarded the nuts to a trade expert, who made the following observations on the samples as received and on the kernels extracted from them:—

(a) *Ground-nuts in Shell.*

No. 1 *Rhodesian Valencia Red* are already known in this market. They are of the Valencia type, and the price here on the spot is about 31s. per cwt.

No. 4 *Masumbika.*—There is no interest for these.

No. 6 *Virginia Bunch.*—These are equal to the Chinese in shell and have to compete against them. The value to-day is about 14s. 9d. per cwt.

No. 8 *Jumbo.*—These are not wanted, and there is no future for them.

(b) *Extracted Kernels.*

No. 1 *Rhodesian Valencia* is equal to Javas and has to compete against them. They are offered to-day at 16s. 6d. per cwt. for November-December shipment and the market is declining.

No. 4 *Masumbika.*—Very similar in appearance to the Chinese, but not so good in flavour.

No. 6 *Virginia.*—Equal to the selected Chinese, 38-40 nuts per oz., which can be purchased at 14s. 6d. per cwt. c.i.f. for November-December shipment.

No. 8 *Jumbo.*—Equal to the best Chinese, 30-32 nuts per oz., value 15s. 6d. to 16s. per cwt. c.i.f.

From the foregoing you will see that there is a market here for the regular kinds. Purchases are usually made in 10-25 ton lots.

The following further information with reference to the points raised by the Chief, Division of Plant Industry, was furnished.

(a) Southern Rhodesian ground-nuts, both in shell and as kernels, have to compete in the United Kingdom chiefly with Chinese hand-picked selected nuts and to some extent

also with the Indian and Spanish products; they have the benefit of the existing import tariff.

(b) A premium over Chinese and Java nuts is obtainable in the market for Rhodesian Valencia nuts in shell, *washed in sand*.

(c) For oilseed crushing, it is more usual to ship ground-nuts as kernels than in shell.

(d) For the barrow trade, bleaching is permissible, provided the kernels are not damaged, and that the treatment given does not render the product liable to penalty under the Food Acts in force in England. Pale pink skins are not essential, though preferred by some buyers. The nuts are not usually graded, but in the case of nuts in shell the more kernels the pods contain the higher the market value. The firm had recently sold certain parcels of Rhodesian ground-nuts, the shells of which had been bleached, and in their opinion rather over-bleached.

(e) For the confectionery trade, kernels with pale pink skins are preferred, but are not essential. Chinese kernels are graded, but grading is not of great importance. The type represented by Large Masumbika kernels is most popular as regards size. Chinese kernels are hand-picked selected; Javan are not.

(f) No special containers are necessary for either nuts or kernels; they are usually packed in bags, sometimes in double bags. The mode of stowage of the kernals is important, and they must not be packed damp. Heating and consequent sweating must be avoided.

(g) The firm did not recommend that attention should be given exclusively to growing Valencia nuts in Southern Rhodesia, but advised that the other varieties should also be cultivated on a moderate scale, as there is a possibility that at a future date some buyers may show a preference for them.

MYCOLOGICAL NOTES.

SEASONAL NOTES ON TOBACCO DISEASES.

5. Evil Effects of Delayed "Priming."

By J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A.,
Government Plant Pathologist.

The continued rain of the past few weeks has brought into prominence a number of diseases which in recent years have not been noticeable until somewhat later in the season, and which have therefore been kept within bounds by the commencement of reaping. It should be noted that since 1927 until last year, the growing seasons in most tobacco areas have been characterised by either low total rainfall or by the occurrence of relatively long dry periods at the critical stage of development of the crop, so that outbreaks of certain diseases capable of causing severe damage have been held in check naturally. That this favourable condition could not be continued indefinitely was emphasised in no uncertain manner last year, when late rains induced the sudden appearance of fungus leaf spots all over the Colony. Frog Eye* was particularly destructive, especially the black barn spot phase which occurred during curing, whilst *Alternaria* Brown Spot† and Shot Hole‡ totally destroyed a number of late planted crops in areas where the diseases had not been recorded previously. That these outbreaks are not confined to one particular season can be demonstrated by their appearance in quantity this year in many parts of the Colony.

It will be asked how these diseases make their way to apparently healthy crops when precautions have been taken

* *Cercospora nicotianæ* Ell. & Ev.
† *Alternaria tabacina* (Ell. & Ev.), Hori sensu Hopkins.
‡ *Phyllosticta* sp. (possibly *nicotiana* or sp. nov.).

to guard against them, and whether after all there is any benefit to be gained from putting into practice the recommendations which have been made constantly for a number of years.

Let us hark back again to the old question—"How many growers really understand the mechanism of plant disease?" Or if they understand the mechanism—do they realise the enormous potentialities of reproduction possessed by the organisms which cause diseases? Some knowledge of what these questions involve is really necessary for a full understanding of the measures which are recommended for eradication and control of diseases. In the departmental "Handbook on Tobacco Diseases"(1), six pages with five illustrations have been devoted to a popular explanation of the nature of plant diseases, but in order to make the matter clearer I will attempt to draw a comparison between a microscopic disease-producing fungus and a common everyday sight—to wit, a tobacco plant. Appearances are usually deceptive, and who would imagine that the agent causing Shot Hole in a tobacco leaf is essentially the same as the tobacco plant itself? In the first place, the fungus is a definite entity, so that, in the words of the old Christmas party game, it must be either animal, vegetable or mineral. It is not animal, having no power of voluntary motion; it is obviously not mineral; it must therefore be vegetable—in other words, a plant. Thus the fungus and tobacco, although widely separated in the vegetable kingdom, are both plants. If we call them by their Christian names, *Phyllosticta* and *Nicotiana*, the similarity becomes more apparent! The bodies of these plants are both composed of cells, but whereas the tobacco plant is made up of a compacted mass of different kinds of cells cemented together, the body of the fungus consists only of a loose weft of threads, comprised of chains of elongated cells invisible to the naked eye.

The reproductive bodies of the two plants are, however, essentially alike, inasmuch as they both produce structures capable of separating from the parent and perpetuating their kind at some distance. In tobacco, they are known as seeds; in the fungus, spores. From the practical point of view, seeds and spores are one and the same thing. The minute black specks seen in the white centres of Shot Hole spots

are really the seed "pods" of the fungus, and in form closely resemble those of tobacco. They possess a relatively thick outer coat, which is filled with minute oval spores in the same way that the tobacco "pod" is filled with seeds. Upon maturity, the fungus "pod" opens, the spores become loose, and are capable of being dispersed in all directions by such agencies as the wind. Thus, when small pieces of diseased leaf bearing reproductive bodies of the fungus fall to the ground, thousands upon thousands of spores may be released and distributed on growing tobacco over a wide area. Or if the rains have finished and dry weather prevails, the spores may lie dormant until the following season, when they may be deposited upon a favourable spot for germination —i.e., a tobacco leaf—and initiate a new outbreak of the disease, in the same way that seeds dropped from mature tobacco will produce a crop of volunteer plants. Not only is there danger of re-infection in the vicinity of the old crop, but the spores may be carried considerable distances—probably miles—by the wind and deposited in seed beds. Such a distribution apparently occurs, because Shot Hole, Frog Eye and *Alternaria* Brown Spot may all be found attacking the lower leaves of seedlings in the beds.

If young tobacco plants affected in this way are put out in the lands, then initial infection for later outbreaks is established early in the season. Apparently, from observations made over a number of years, this is what takes place on most tobacco farms. In many instances, complete destruction of whole fields just before reaping time can be attributed to the presence of some disease upon the lower seed bed leaves which have not been removed from lands at an early date.

It is my experience that no set of transplants is entirely free from Frog Eye. As soon as the bottom seed bed leaves begin to turn yellow and wither, Frog Eye spots containing masses of spores commence to develop on them. These spores are eventually transferred to healthy leaf, and if they do not start the disease in the lands, then they inevitably cause serious black spotting in the barns. In the same way *Alternaria* Brown Spot and Shot Hole travel the vicious circle, and have been observed in abundance this year. Their widespread occurrence may quite conceivably be attributed

to an unusual "carry-over" of infection from crops which were heavily infected last year, and in a number of cases abandoned.

How, then, is this vicious circle to be broken? Efficient spraying of seed beds with proper equipment undoubtedly helps, but may not be infallible. Rotation of crops is also necessary. But the one essential operation, about which pages have been written in this Journal, is the **early** and **complete** removal of the lower leaves of young plants. If seedlings have been allowed to become yellow, and as a consequence spotting is general, then the young plants should be stripped to the bud, *every* leaf which has unfolded being removed. There need be no fear of damaging the crop by such treatment in the early stages, for after two weeks or so the effect of drastic stripping is not noticeable, except for the clean and tidy appearance of the field. It should not be necessary to add that all primings must be removed from the lands and destroyed as soon as possible.

It may be asked why this article appears in February, when priming should have been carried out in December. The answer is obvious. These same recommendations have been made for years past at a seasonable date before infection becomes rife, but it is now thought advisable to call attention to the effects of late priming, which are visible on all sides.

Your slogan should be **"Priming or Privation."**

One note of warning: Do *not* start priming until plants have put out several new leaves, in order that those affected by mosaic may be detected and dealt with in the usual way.

REFERENCE.

(1) Hopkins, J. C. F.—"Diseases of Tobacco in Southern Rhodesia." *Ministry of Agri. & Lands.* Salisbury, 1931.

DAIRY TESTS AND CALCULATIONS.

By F. A. Lammas, Dairy Officer.

The following article describes some of the more common tests and calculations with which all dairy workers should be familiar; a simple method for fumigating and removing taints from the dairy is also outlined. Most of the tests are quite simple and can be easily carried out by the average dairyman or dairy farmer.

1. The Quevene Lactometer.—The lactometer is a specially graduated hydrometer for rapidly determining the specific gravity of milk. It is graduated from 15 to 40 and in many cases has a thermometer attached.

Value of Readings.—

15 on the scale indicates a specific gravity of 1.015

21 on the scale indicates a specific gravity of 1.021

40 on the scale indicates a specific gravity of 1.040

To Use the Lactometer.—(1) Place the lactometer in the milk the latter being regulated to 60° F. and leave for half a minute for the instrument to take up the temperature. On no account should the reading be taken after the lactometer has been in the milk for more than half a minute, as the fat in milk rises to the surface and interferes with the accuracy of the reading.

(2) Read the mark on the scale which is clearly visible through the upper part of the meniscus.

Note.—The specific gravity of milk should not be determined until it has aged for at least one hour and then only when it has been thoroughly stirred so as to distribute the fat evenly throughout the bulk.

The temperature at which the milk should be at the time of ascertaining the specific gravity will be found marked on the stem of the lactometer; usually this is 60° F.

Wherever possible this temperature should strictly be adhered to and every effort made to maintain it if accurate results are aimed at. However, with the aid of a correction accurate results may still be secured, provided the temperature does not vary more than 5° above or below 60° F.

Correction.—Add .1 to the lactometer reading for every degree the milk is above 60° F. Subtract .1 from the lactometer reading for every degree the milk is below 60°F. Thus a reading of 32 on the lactometer when the milk registers 62° F. would indicate a reading of 32.2, the specific gravity being 1.0322. Were the temperature of the milk in the above case 57° F. the corrected reading would be 31.7 (32 minus .3) and the specific gravity 1.0317.

2. Estimation of Solids in Milk.—To determine the percentage total solids in milk when the percentage fat and the lactometer reading are known.

Rule.—Multiply the lactometer reading by $\frac{1}{4}$ to the result of which add the product obtained by multiplying the percentage of fat in the milk by $1^1/_5$, to which is added .14. The formula is as follows:—

$$(\tfrac{1}{4}\text{ lactometer reading})\text{ plus }(^6/_5\text{ fat})\text{ plus }.14.$$

Example.—Estimate the percentage total solids in a certain sample of milk testing 4.5% butterfat, the lactometer reading of which is 32.

$$(\tfrac{1}{4} \times 32)\text{ plus }(^6/_5 \times 4.5)\text{ plus }.14$$
$$8 \quad \text{plus} \quad 5.4 \quad \text{plus } .14$$
$$13.54\%\text{ total solids.}$$

The percentage of solids not fat would be calculated by subtracting the percentage of fat from the percentage of total solids.

In the above case 13.54 minus 4.5 = 9.04% solids not fat. Milk offered for sale in municipal areas in Rhodesia must contain not less than 3.0% butterfat and 8.5% solids not fat, making in all 11.5% total solids.

3. The Marshall Rennet Test.—This test is used exclusively by cheese-makers to detect the ripeness of the milk, and the time the rennet should be added. The "Marshall" enamel vessel is filled to the O mark with the milk to be tested at 84°-86° F. 1 cubic centimetre of rennet

diluted with 6 times its bulk of water is next added and mixed thoroughly with the milk. The vessel is placed in such a position—usually at one end of the cheese vat—that the milk may run freely from the outlet. When the milk has coagulated and has ceased to flow through the faucet the number of exposed graduations on the vessel indicates the ripeness of the milk. The riper or more acid the milk the fewer graduations will be exposed. Under usual summer conditions the milk is sufficiently ripe for the addition of rennet when 6 to 7 spaces are exposed, and during winter months when $4\frac{1}{2}$ to $5\frac{1}{2}$ spaces are exposed.

The accuracy of this test is dependent upon the strength of the rennet used. It is therefore advisable to purchase the best procurable and if possible to purchase one brand only, when it is almost certain that one tin will be uniform in strength with another.

4. Test for Acidity in Milk.—Measure carefully one dram of rennet and place in an ordinary tea cup together with a few pieces of burnt match. Four ounces of the milk to be tested are next measured and the temperature adjusted to 86° F. Pour the milk rapidly on to the rennet and stir vigorously for 8-10 seconds (not longer). Note carefully the time of adding the milk, on the second hand of a watch.

As the milk commences to thicken the portions of burnt match will gradually cease rotating, and when coagulation is complete movement will cease entirely; at this stage the time should again be noted. The number of seconds required to coagulate the milk, that is from the time the milk is added to the rennet until the match-sticks stop moving denote the ripeness of the milk. For a quick ripening cheese little acidity is desired and the time by this test varies from 24-26 seconds. For a slow ripening cheese more acidity should be developed before adding the rennet; the time will then be from 20-22 seconds.

Note—

1 teaspoon = 1 dram.

8 drams = 1 fluid oz.

5. Test for Acidity in Milk, Cream and Whey.—The apparatus required for this test is a burette graduated in

cubic centimetres and 1-10th cubic centimetres; a 9-cubic centimetre pipette, a small quantity of Phenolphthalein as an indicator and a supply of tenth normal caustic soda solution.

It is advisable to have the caustic soda solution prepared by a reliable chemist, as it is upon this solution that the accuracy of the test depends. The Phenolphthalein may be procured from the same source.

The Test.—Nine cubic centimetres of the milk or whey to be tested are discharged into a tea cup and two or three drops of Phenolphthalein added. Sufficient soda solution is then run from the burette into the milk or whey to change its colour to a permanent pale pink. When this colour is obtained the acid present has been completely neutralised and the amount of caustic soda required to bring about this change indicates the percentage acidity.

Value of Readings—

$3\,{}^{2}/_{10}$ ccs. reading on the burette indicates .32% acidity.
$2\,{}^{5}/_{10}$ ccs. reading on the burette indicates .25% acidity.
5 ccs. reading on the burette indicates .5% acidity.

The same test holds good for determining the acidity of cream, but as the latter is slightly lighter than milk and acidity test is based on weight, more accurate results are obtained if 9 grams of cream are weighed and diluted with an equal amount of water before the test is made. The addition of the water does not in any way interfere with the final result, the reading being taken on the burette as for milk. It frequently happens that for some reason or other the butter or cheese-maker does not possess a 9 cc. pipette and is thus unable to carry out this test. With the aid of the following formula the acidity present in milk, etc., may be ascertained irrespective of the size of the pipette employed.

Formula.—Multiply the number of cubic centimetres of caustic soda solution required to neutralise the milk tested by .009, and multiply the result by 100. The product obtained divided by the number of cc.'s of milk, etc., used to make the test will represent the percentage acidity.

The above formula may be better explained thus:—

$$\frac{.009 \times \text{No. cc.'s caustic soda solution} \times 100}{\text{No. of cc.'s milk, etc., used.}}$$

Example.—Supposing 4 cc.'s normal tenth caustic soda solution are required to neutralise 10 cc.'s milk, what is the percentage acidity?

$$\frac{.009 \times 4 \times 100}{10}$$

= .36% acidity.

The caustic soda acidity test finds its most common use in the cheese factory, and with this equipment the cheese-maker is able to turn out a fairly uniform quality cheese from day to day. Cheddar cheese-making, broadly speaking, is a question of acidity from the commencement of the process to the end, and the acid test is used in deciding when to add the rennet and when to draw the whey.

The milk is sufficiently ripe for the addition of the rennet when the acidity present is .19% to .2% during the summer months and .22% in the winter. The time for drawing whey from the curd is indicated when the acidity in the whey is .2 per cent. The amount of acidity to develop in the whey especially at this stage of the process depends entirely on climatic conditions and the length of time the cheese is required to ripen. During the summer months and when quick ripening cheese is required, the whey may be drawn when it registers .18% to .20% acidity. During winter, however, a higher acidity may be allowed to develop before drawing the whey.

The acidity present in the whey when the curd is cheddaring (when the curd is piled) again indicates when the curd should be milled. This will vary from .65% to .8%, dependent again on the time the cheese is required to ripen.

A cheese required for quick sale should be milled when the whey running from the curd registers .6%-.7% acidity, and for a cheese intended for long ripening .8%-.85%

(*To be concluded.*)

SECOND LOCUST INVASION, 1932.

MONTHLY REPORT NO. 1, DECEMBER, 1932.

1. **Nomadacris septemfasciata.**—Swarms of the red locust commenced to invade Southern Rhodesia late in November, the first report being from Matetsi, in the Wankie district, on the 29th. It is not known whether the first swarms came from the Bechuanaland Protectorate or from Northern Rhodesia, but some later swarms are known to have come from the north. From early reports received, the general trend of direction appeared to be S.E. to S.W., but it soon became evident that the swarms were circling. Early in the month further swarms crossed from the north into the Lomagundi district, and on the 12th a swarm, believed to have come from Portuguese territory, appeared in the Inyanga district. It seems likely that swarms entered the Colony along the whole northern boundary, and possibly the northern sections of the eastern and western boundaries.

Towards the end of the month egg-laying became fairly general throughout the Colony. The districts invaded, egg-laying being reported where stated, are as follows:—Wankie (eggs), Nyamandhlovu (eggs), Bulalima-Mangwe (eggs), Matobo, Bulawayo, Umzingwane, Insiza (eggs), Belingwe (eggs), Gwanda, Chibi (eggs), Victoria, Selukwe, Gwelo (eggs), Bubi, Sebungwe, Hartley (eggs), Lomagundi (eggs), Mazoe (eggs), Salisbury (eggs), Mrewa, Mtoko, Inyanga, Makoni, Marandellas (eggs), Charter (eggs), Bikita (eggs), Ndanga (eggs).

No hoppers of this species were reported during the month.

2. **Locusta migratoria migratorioides.**—A few swarms of the tropical migratory locust invaded the Darwin district from the north, apparently late in November, although the

first report was made on 4th December. Egg-laying commenced at once, and hoppers appeared in the Zambesi Valley on the 15th. Specimens of fliers from a few swarms from the Mazoe district, mainly red locusts, included specimens of migratory locusts.

It has been difficult to trace the course of the tropical migratory locust, as it has been to some extent confused with the red species. Specimens have been received from the districts of Darwin, Mazoe, Mrewa and Gwelo, and it is suspected that the species is present in Hartley and Mtoko. Hoppers have appeared in Darwin, Mazoe and Mrewa. A number of hopper swarms have been successfully dealt with by farmers and by the Government. Beating with brushwood is stated to have proved successful in the Mazoe district, where eggs have hatched on cultivated lands.

3. **Damage.**—Thousands of acres of maize have been severely damaged by the fliers, but, probably owing to the cloudy weather, most of the crops are apparently recovering.

4. **Locust Campaign.**—The Government has organised a campaign for the destruction of hoppers, and is responsible for destroying hoppers on Crown lands and in native reserves. In settled areas the owners are responsible for the destruction of hoppers, free poison being issued, and pumps being loaned to those responsible.

RUPERT W. JACK,
Chief Entomologist.

A. Greenii.

A. Peglerae.

A. Thorncroftii.

NOTES ON AFRICAN ALOES.

By H. Basil Christian, "Ewanrigg," Arcturus.

PART VI.

Aloe Peglerae.—*Aloe Peglerae* is found on the stony hills of the Magaliesberg near Pretoria and on the Witwatersberg Range. It is one of the most easily recognisable of the aloes, even when not in flower, owing to its habit of growth, and once seen in flower, could never be forgotten or mistaken for any other species.

It is an acaulescent plant. The leaves are very lax and incurved, about 12 ins. long and 2 ins. broad low down, pale glaucous green in colour, unspotted, almost flat above and slightly convex below; faintly keeled and with a few spines on the uppermost third of the lower surface, with spines on the margins.

It throws up a single unbranched peduncle from the centre of the rosette of leaves ending in a cylindrical raceme about 6 ins. or more long. The flowers are at first rose-coloured, changing to white or greenish-white on maturity. The stamens and style project from the perianth for a considerable distance, the exserted portion being dark purple with terra cotta colour anthers, the included portion being yellowish-green.

Altogether a very striking looking aloe, which flowers at Ewanrigg in August and again in September-October.

Aloe Thorncroftii.—*Aloe Thorncroftii* occurs in the mist belt on the mountains around Barberton, Transvaal. It flowers at Ewanrigg in August and on into September and October.

It is an acaulescent plant, or with a short stem. Leaves, 25-30 in number, in a dense rosette, dark green, very slightly glaucous and unspotted, about 12 ins. long, 3½-4 ins. broad at the base, with pale brown teeth on the margins.

The inflorescence consists of one or two erect unbranched peduncles (very rarely branched) reaching a height of 3 ft. to 4 ft. Usually a second inflorescence appears after the first has died down.

The perianth, which is rose-coloured, is cylindrical, not constricted above the ovary, and is 2 ins. long, which is above the average. The inner perianth segments are slightly longer than the outer and greenish at the apex. The stamens are just exserted and have pink anthers; the style is yellowish-green, finally exserted.

Owing possibly to the length of the perianth making it unattractive to honey birds, it has not set seed freely with me.

Aloe Greenii.—*Aloe Greenii* has been known for a long time, but its actual habitat was uncertain until Dr. I. B. Pole-Evans found it growing near Maritzburg, Natal.

It is an acaulescent plant, or with a short stem, with 12-15 leaves, about 15-18 ins. long and 2½-3 ins. broad low down, bright green with obscure lines and broad irregular transverse wavy bands of confluent, oblong, whitish spots, the markings on the under surface being as distinct as on the upper surface; brown, horny prickles on the margins. The peduncle reaches a height of 3 ft. 6 ins. to 4 ft. under cultivated conditions in Southern Rhodesia, usually with 5-7 branches, ending in panicles about 6 ins. long, the end one being up to 9 ins. long. Perianth pale red, about 1¼ ins. long, the corolla tube being much constricted above the ovary. The stamens and style are not distinctly exserted.

This aloe increases so rapidly, by means of underground suckers, that it is inclined to form an untidy mass after the first season, but these are easily removed and the aloe is worth growing for its leaf markings alone.

THE CONDITIONS GOVERNING THE HIRE OF GOVERNMENT BORING MACHINES.

The conditions under which farmers and other private applicants may obtain the services of the Government drilling machines for the purpose of boring for water are defined in Government Notice No. 546 of the 20th September, 1929, and copies of these regulations are obtainable on application to the Irrigation Division.

The following fuller details regarding certain sections of these regulations are published for general information, as applicants in the past have sometimes complained that regulations of this nature are not sufficiently self-explanatory and that they do not know what their commitments are likely to be if the services of one of these machines is obtained.

Charges Involved.—Charges for the drill are on a daily and not on a footage basis, a day being reckoned as a 9½ working-hour period. The costs involved in hiring one of the machines comprise—

(a) a charge of £3 per day whilst the drill is being set up or dismantled and for carrying out a pumping test (12 hours or under);

(b) a charge of £6 per day whilst actual boring or essential operations in connection therewith are in progress;

(c) a charge of £5 per day for any delays due to applicant not supplying fuel, water or transport;

(d) the cost of casing put down to line the borehole; the cost of casing varies according to prices prevailing at the time, but may be taken to range from 3s. 6d. per foot for 5-inch to 4s. 3d. per foot for 6-inch diameter casing.

In addition, the applicant has to provide fuel and water for the operation of the drill, and transport for the drill and

equipment from the nearest railway station or such other convenient point as may be determined by the Chief Engineer. In the case of farmers who have transport available, the provision of the additional services as detailed above does not entail any actual out-of-pocket expenses.

Average Costs.—The list of charges detailed above appears formidable, but in actual fact the boring costs do not, on the average, amount to a considerable sum, and are cheaper than sinking wells to a corresponding depth in similar formation.

The only cases in which complaints are received as to the high cost of boring are those where more than one borehole has had to be sunk on a property before a supply is obtained.

During the last eight years, the total footage drilled for private applicants has amounted to 32,457 feet, at an average cost of 17s. 7d. per foot, *including the price of casing supplied.* This footage represents 268 boreholes which have been sunk for private applicants, of which 73 per cent. have yielded useful supplies of more than 2,500 gallons per day at an average depth of 121 feet.

From this it will be seen that the total cost per borehole is under £110, and it will be admitted that if all boreholes could be guaranteed to be sunk for this figure, there would be no cause for complaint. Unfortunately, however, there can be no guarantee of this nature, as the costs vary considerably in different formations, and during the period in question the costs for individual boreholes have varied from 8s. 4d. per foot to 36s. 8d. in extreme cases; but in the great majority of cases it is safe to assume that the cost per borehole will not exceed £150.

Methods of Payment.—There are four methods by which payment of the boring charges may be made, viz.:—

(a) *By payment of a cash deposit of £75* and such additional sum as may become due after completion of the work.

(b) *By payment on demand* after completion of the work. If the applicant can provide approved security, payment on demand may be extended to

mean payment by instalments over a period not exceeding two years.

(c) *By an advance from the Land Bank*: In these cases applicants have to submit a certificate from the manager of the Land Bank stating the amount of the advance that has been approved.

(d) *By an advance from Irrigation Loan Funds*: An application for an Irrigation Loan is not usually considered unless the applicant furnishes proof that he is unable to obtain an advance for the purpose from the Land Bank. An applicant who wishes to take advantage of these facilities should make application on a separate form for a loan to cover the estimated cost of the boring charges, the necessary forms being obtainable from the Irrigation Division.

These loans are granted normally subject to 5 per cent. interest per annum and are repayable in annual instalments, the period of redemption varying from 5 to 15 years, dependent on the amount of the loan. The first annual instalment is usually called for about a year after the completion of the work.

The security required for an irrigation loan is either two personal sureties who are holders of immovable property in Southern Rhodesia; or failing that, the loan will be registered against the title deeds of the farm at no extra expense to the applicant.

All applications for irrigation loans have to be approved by the Governor-in-Council.

Classes of Government Drills (Section 13).—The standard equipment at present supplied consists of a percussion or "jumper" drill for boring through soft formation, and a rotary shot drill for boring through hard rock. Either drill may be brought into operation as required.

The rate of drilling in soft formation with the percussion drill is generally from 20 to 40 feet per day, and in rock formation with rotary drill from 2 to 8 feet per day.

Transport (Section 15).—The rotary and percussion drills each require a full span of 16 oxen or the equivalent to

transport them. In addition to the plant itself, there are usually two full-sized wagon loads of equipment, such as tanks, casing, tools, etc., and the necessary wagons and oxen must be provided by the applicant for their conveyance. A further span of from four to twelve oxen, depending on the condition of the road to be traversed, will be required for the caravan occupied by the drill foreman in charge of the plant.

A wagon is provided with some of the outfits for riding wood and water during boring operations, and when such is available it may be placed at the disposal of the applicant for transporing the equipment. The applicant is expected, whenever possible, to provide the necessary service under this heading, either with his own transport or by means of transport hired or otherwise obtained by himself. Where he is unable to do so, the Government will hire or supply the necessary transport from the most convenient source and debit the cost thereof to the applicant.

Fuel and Water (Section 16).—The drills are driven by steam, and the amount of fuel required depends entirely on local conditions, but the applicant should be prepared to provide up to a cord of wood per day for each day the drill is actually working. The wood should be perfectly dry and of good heat-giving qualities. In the event of suitable wood not being available, coal can be used, in which case approximately five bags of 200 lbs. each will be required per working day.

During boring operations, a quantity of water is required to operate the drill. Approximately 600 gallons is required for percussion drilling and up to 2,000 for shot drilling, of which 400 gallons are required for use in the boiler and should be of the purest quality obtainable. For the actual boring, practically any water can be used, providing it does not contain too much mud or silt. The plant is provided with square tanks of 200 gallons capacity, which can be conveniently carried on a wagon for conveyance of water from the source of supply to the drill.

General.—An application for the hire of a drill must be submitted on the prescribed form, and it may be noted that the declaration of surety need only be completed and

stamped by the applicant when he is specially requested to do so.

Since the charges are based on a daily rate, it is in the applicant's own interest to render all assistance possible for the expeditious carrying on of the operations.

The drill foremen are instructed to submit their weekly reports to the applicant for signature before forwarding them to the Irrigation Engineer, and applicants are advised to satisfy themselves that the information contained therein is correct, as discussion as to their accuracy cannot afterwards be entered into.

GRASS SILAGE.

By The Division of Plant Industry.

In most parts of the Colony the plentiful rains experienced—several inches above normal at the date of writing—have brought on an exceptionally luxuriant growth of grass. What is to be the fate of this bounteous supply of feed? It is far in excess of the amount which can be utilised by the available stock on most farms. Each day, after the flowering period of the grass has been passed, its feeding value is reduced. Food manufactured and at present still in the leaves and stems will quickly be utilised in the formation of seed (not to any extent eaten by live stock) or will be transferred to the root system. In a few short weeks the feeding value of the veld will have fallen to less than one-third of its worth at the present time. For how much longer will the majority of Rhodesian stock owners rest content to allow this immense wealth of natural feed to fritter itself away—finally, over huge areas of the Colony, to be dissipated in flames and smoke.

While it is true that in the majority of instances last season's efforts to produce stack silage from veld grass were

not generally successful, it is equally true that in no case have we heard of failure when the grass was ensiled in a pit or trench silo.

A regular trade in the export from Rhodesia of chilled and frozen beef appears well on the way to realisation, but the essence of success lies in cheap and economical feeding. The cheapest food of all is the natural grass of the country, and it has already been shown that if properly ensiled this provides a fodder of excellent palatability and feed value.

The trench silo of any convenient length, with the end walls sloped downwards towards the centre, and of a width sufficient to permit the easy passage from end to end of the trench of a wagon and oxen, enables veld grass silage to be made successfully and very economically. The trench need not be very deep—five to seven feet will suffice in most cases—and the fact that the loaded wagons pass through the trench to unload, and over each successive layer of fodder, materially assists in thoroughly packing down the grass and so preventing ingress of air. There are comparatively few farmers who have not at one time or another converted maize or similar cultivated crops into silage in a pit silo. With the modifications mentioned above, the principles of filling the trench silo are precisely similar in all respects.

The cutting of the veld for grass silage or hay not only enables the resulting fodder to be conserved in a palatable and nutritious condition, but, further, by reason of the aftermath which follows, improves the grazing worth and stock-carrying capacity of the land from which the growth is thus removed.

Let 1933 see a really determined effort on the part of farmers to utilise profitably the huge supplies of valuable feeding material which lie ready to our hands but which, for the lack of organised endeavour, are now for the most part wasted. Once the stage is reached of properly conserving the surplus summer growth of natural grass in the form of hay or silage, the spectre of winter poverty of cattle and delayed maturity will be banished.

The following is the result of a partial analysis of grass silage made in a small pit silo on the Government Pasture Research Station, Marandellas, last winter and kindly

supplied by the Chief Chemist to accompany this note. The fodder which was mown from one of the paddocks contained a good deal of "Vaalbos" (*Eriosema englerianum*).

The sample was drawn from the pit on the 10th August and the moisture content was found to be 60.67 per cent. Prior to the analysis being made, the Vaalbos, which comprised nearly 50 per cent. of the herbage, was separated from the grasses and the two fractions were then analysed separately with the undermentioned results:—

Analysis of Air-dried Material

	Crude Protein.	Lime (CaO).	Phosphoric Oxide (P_2O_5)
Grass	4.2	0.34	0.22
Vaalbos	10.79	0.90	0.28
Mean of Mixture	7.5	0.62	0.25

The protein content of this silage compares not unfavourably with maize silage made in a pit, which usually contains about 7-8 per cent. crude protein. Vaalbos is present to a greater or lesser extent over a large part of the grassveld of the Colony and though not much eaten by stock when green (except when very young and other grazing is scarce) yet it and other wild legumes occurring in the pasture can generally be relied upon to raise the protein content of veld grass silage to something very near the figures quoted.

CROP RETURNS FROM CONTACT SOILS.

The farm Tarara in the Marandellas district, adjacent to Theydon Siding, has been farmed intensively during the last few years in accordance with the advice of the Division of Plant Industry, and the returns now submitted by Mr. L. C. Roberts will, we feel sure, be studied with interest by other farmers situated on similar land. The soil is typical red contact sand, and the returns quoted serve once again to indicate the possibilities of intensive farming in Rhodesia.

In 1929-30, Mr. Roberts reaped 453 bags of maize, or 12½ bags per acre, from 36 acres, while during the past season he reached an average of 17 bags per acre, or 602 bags from 35 acres. The response to green manuring on this type of land has been most striking. In 1931-32, maize receiving 200 lbs. of raw rock phosphate per acre (ploughed in 4 inches deep), and following sunflower ploughed under, yielded 21 bags per acre.

Ground nuts yielding 20 bags per acre of sound nuts have proved a valuable crop, and there is little doubt that this yield can still be appreciably increased.

On this particular soil, the burning of sunflower stalks on the land has proved very beneficial to a following maize crop, which yielded 17 bags per acre without any additional fertiliser. The importance of the early planting of maize on the high veld—which operation should be completed by the first week in December at the latest—may again be reiterated.

Field No. 3: Area 12 Acres.

	Yield in Bags per Acre.
Season 1927-28—Tobacco, plus 200 lbs. per acre of Tobacco No. 4 Fertiliser	Crop frosted
Season 1928-29—Yellow Maize without Fertiliser	6⅙
Season 1929-30—Maize, plus 100 lbs. of Double Complete Fertiliser per Acre	12½
Season 1930-31—Green Manure: Sunflower ploughed under	...
Season 1931-32—Maize, plus 200 lbs. per Acre of Raw Rock Phosphate ploughed in	21

In 1931-32, all maize was spaced 40 by 18 inches apart. The rainfall for the three seasons was as follows:—

1929-30	38.01 inches.
1930-31	30.68 inches.
1931-32	34.34 inches.

Field No. 5: *Area* 12 *Acres.*

	Yield in Bags per Acre.
Season 1929-30—Maize, plus 200 lbs. of Bone and Superphosphate per Acre	12½
Season 1930-31—Maize without Fertiliser	12
Season 1931-32—Maize without Fertiliser (6 acres only planted)	13

This field was virgin land, broken up during the rainy season of 1928-29. In 1931-32, the maize was planted early in November. In 1930-31, 1 acre was planted to sunflower without fertiliser and yielded 8 bags of seed. The ripe sunflower stalks were cut and burnt on the land, and the following season the maize after sunflower, without any fertiliser treatment, returned 17 bags an acre.

Field No. 8: *Area* 25 *Acres.*

	Yield in Bags per acre.
Season 1930-31—12 Acres Ground Nuts (Rhodesian Valencia) without Fertiliser, after Maize with Fertiliser ... ... (Yield of Ground Nuts in Bags of 75 lbs. each net.)	20
Season 1930-31—3 Acres Potatoes	Not recorded
Season 1931-32—8 Acres Oats	Not recorded
Season 1931-32—16 Acres Maize without Fertiliser	16

PAMPAS GRASS AS A FODDER CROP.

The New Zealand Journal of Agriculture for October, 1932, contains an interesting article on the value of this grass (*Gynerium argenteum*), so well known as a garden ornamental, for forage purposes.

It appears that Pampas Grass of recent years has become naturalised in New Zealand, and, having been found resistant to considerable frost and to be well liked by cattle, attention has been given to it as a fodder plant.

The writer of the article in question, Mr. B. C. Aston, Chief Chemist of the New Zealand Department of Agriculture, describes experiments carried out by a Mr. A. McClean, farming what is termed good swamp land in the Hauraki Plains. Test cows which have spent four winters on pampas grass are said to be the outstanding animals on the farm, with coats and condition as if fed on linseed.

"Cattle eat the pampas down in breaks with a movable fence; it does not need to be cut for them. Mr. McClean has tried cutting and feeding out the pampas like other crops, but there seems to be too much wastage, and cattle certainly prefer grazing the standing tussocks."

The grass is said in New Zealand to grow so rapidly that in twelve months each clump will yield up to 1 cwt. of forage. Samples of the Hauraki pampas have been analysed by the New Zealand Department of Agriculture, with the following results:—

	Water Per cent.	Ash Per cent.	Protein Per cent.	Phosphoric Acid Per cent.
Pampas grass	71.4	2.27 (8.16)	2.46 (8.71)	0.1 (0.36)
Green maize	81.0	3.0 (15.0)	1.9 (9.37)	0.12 (0.62)
Green oats	82.2	1.6 (8.9)	2.7 (15.7)	0.15 (0.84)

Illustrations accompanying the article show that on Mr. McClean's farm the pampas is growing on partially drained swamp land on which the water-table is within 12-15 inches of the surface. The chemical analysis quoted above indicates that this is a grass of good feed value and digestibility. One would imagine that the saw-edged leaves would cause much laceration of the lips and tongues of cattle grazing upon the mature plant, but in the particular instance in New Zealand this does not seem to be the case.

Whether pampas grass grown on vlei and swamp soils in Rhodesia will prove equally palatable and of equal feed value remains to be seen, but it would certainly appear worthy of trial under the conditions indicated. This grass usually seeds freely, and limited supplies of seed or root divisions are probably obtainable from a number of private gardens in Rhodesia and from some of the municipal parks.

FARMING CALENDAR.

February.

BEE-KEEPING.

In most parts of the two Rhodesias this month is one of fair activity for all bees, there being as a rule quite enough nectar, pollen, etc., available for all ordinary purposes of rearing, building cells, etc., and working generally for the due upkeep of the colony for the present as well as for the coming winter. Whether there will be any surplus honey for them to store will depend upon what crops the farmer may have on hand at this time, as the usual flora of the land will not supply it until the regular second flow of the year is due, which should be in March to April, according to the season.

Watch carefully for robbers, though, with well attended hives and due care in handling, there should be little to fear in this direction; strong, well filled hives can always repel robbers, which are only successful with weak colonies, and these no apiarist should ever have under his care. Mark well last month's advice, i.e., to have everything in readiness for dealing with unexpected new swarms that may be required as they may come, for nothing is more disconcerting or annoying than to be unready when the time arrives. This applies especially to any swarms that may come from the apiary, for a few days only of neglect of such a hive may easily lead to the moth taking early possession of the combs, and in practically a few hours destroy fully drawn-out combs that would otherwise be of much value for after working upon. Such combs, as they are available, should at once be packed away in an air- and moth-tight box or tin for after usage.

CITRUS FRUITS.

Newly-planted citrus trees should be kept free of weed growth likely to exclude necessary air and light for their normal and healthy development. Citrus trees planted in February seldom give satisfactory results; late planted trees do not mature their new growths before winter, and they are more susceptible to winter injury or the ravages of disease or insect pests. The early planted cover crops will be fit to plough under by the end of the month. Do not delay this operation for fear of the rains ending abruptly. If this occurs, great difficulties will be experienced when attempting to plough in the green crops. Keep all young shelter belt trees free of weed growth, and loosen the soil round their stems fairly frequently to eliminate possible ant injury. This is one of the best months for budding citrus trees, either in the nursery or grove—trees that are to be top worked to profitable varieties. Late out-of-season fruit that may have set during December-January should be stripped from the trees. This fruit is valueless for export, and if allowed to mature, will affect the main crop setting of fruit.

DECIDUOUS FRUITS.

When sufficiently mature, plough under cover crops. This should be possible towards the end of the month.

Summer pruning should be completed early in the month; little or no advantage will be derived from trees treated when the new wood reaches maturity.

Do not allow fruit to become over-ripe, then expect remunerative prices for it. If it is harvested at the correct stage, then well graded and neatly packed, good prices may be expected for the surplus fruit sold.

This is a good month for budding deciduous fruit trees.

CROPS.

Cultivate, and keep on cultivating as weather permits, to destroy weeds. Continue to look out for stalk borer, and, if infection is discovered, deal with infested plants as advised in January notes. Watch witch weed and continue cultivating and hand pulling it. Plough under witch weed, smother and trap crops. Where practised, maize can be under-planted with sweet potato vines after the last cultivation for the following season's requirements. Potatoes and ground nuts will probably need to be ridged again. Catch crops of quick maturing beans, such as tepary bean, also buckwheat, can still be sown. Keep down all noxious weeds. This work can be undertaken on wet days. Make veld grass hay whenever a few days of fine weather permit. Early mowings provide the best hay. Seed beds of onions for early winter planting can be sown towards the end of the month. Keep potatoes in a cool shed, well ventilated. Pick over any potatoes in storage and remove bad ones. Continue to make as much farm manure as possible. Begin to ride manure and place in heaps handy to the lands to be manured.

ENTOMOLOGICAL.

Maize.—The first brood of the stalk borer matures this month, and the young of the second brood may be found amongst the younger leaves. Weeds should be kept down.

Tobacco.—Stem borer, leaf miner and budworms are the chief pests likely to be troublesome. Plants in the field found infested with the first two insects should be heavily pruned or destroyed. The budworm caterpillars can usually be hand picked during the process of topping. (See "Rhodesia Agricultural Journal," December, 1927.)

Potato.—Ladybirds and tuber moth may call for attention. The latter, when very bad, sometimes causes considerable wilting of the crop besides attacking tubers. The ladybirds may be destroyed by spraying with arsenate of lead 1 lb. to 16 gallons of water.

Cabbage Family.—All members of the family are liable to be attacked by the sawfly and webworm. The sawfly may be effectively controlled by dusting during a dry spell with Paris green and slaked lime (1 lb. Paris green and 20 lbs. slaked lime).

Melon Family.—The most important pest is the melon fly, which "stings" the fruit of all species of gourds. Destroy all badly "stung" fruit and spray remainder thoroughly with arsenate of lead (2 ozs. in 4 gallons of water) to which 2½ lbs. of cheap sugar has been added.

Deciduous Fruit.—Apples, pears and late peaches suffer chiefly from fruit moths, which puncture the fruit. No remedy available except covering the trees with netting.

Fig.—The fruit is liable to the attack of the fig weevil. All infested fruit and all wild fruit should be collected and destroyed. The borer in the stem may be killed by inserting a little carbon bisulphide into the burrow and sealing it up.

Poison Baiting.—Poison baiting against surface beetles, cutworms, etc.: No really effective bait has yet been discovered for cutworms, but the following poisoned bait is recommended for surface beetles, etc.: Paris green 1 lb., 180 lbs. maize meal. Mix thoroughly in dry state and add water until the material is of the consistency of a dough. Roll into small balls and place under shade. Spread in the evening.

FLOWER GARDEN.

Sow carnations, phlox, pansy, verbena, gilias, larkspur, dianthus and pentstemon. The flower garden should be now looking its best, nearly all plants being in bloom. Old and dead flowers should be constantly removed, except when the seed is required. Seeding of the plants shortens their flowering period. All runners and climbers should have constant attention, and be tied up and trained, otherwise they will be damaged by the wind. Dahlias, chrysanthemums and carnations will require staking, as they become top heavy when in flower. Make the first sowing of winter-flowering sweet peas.

VEGETABLE GARDEN.

Sow now—Beans, beet, cabbage, cauliflower, lettuce, peas, onions, carrots, parsnips, turnips, endive, kohl rabi, rhubarb and all herbs.

FORESTRY.

Tree planting operations should be carried out on dull, showery days or late in the afternoons. Take care in setting out the plants, avoid bending the roots, and do not plant deeper than the plants were in the seed beds or trays. Steps should be taken to prepare seed beds for the slower growing species, i.e., pines, cypresses and callitris, and seed of these species should be sown for the following season's planting.

GENERAL.

This is a busy time for the farmer. Weeds will be very much in evidence and difficulty will be experienced in keeping them under. Stock will have fully recovered their condition, but ticks will be troublesome. The dipping tanks must be fully utilised now.

POULTRY.

Cockerels for future breeding should now have been selected, and those not good enough sold for killing. It pays far better to get rid of all of the latter, even if only at 1s. or 1s. 3d. per lb., than to keep them on, eating their heads off, in the hope of getting a better price. Those good enough for breeding, and they must be good, should be kept till about June; there is a demand for such up to this month. Any surplus at this time should be eaten or sold for what they will fetch. Of those selected for breeding purposes, the owner should keep the best one or two for his own use, with another as a reserve. No poultry keeper should sell his best stock, no matter how high a price is offered for it.

By the end of this month the birds selected for breeding should be mated up. If it is possible, the birds selected for breeding should be given a run on free range for three weeks or so before being put into the breeding pen and fed sparingly; better fertility and better chicks will be the result. If it is possible to run the birds selected for breeding away from the others during the whole of the breeding season, all the better. Any hens that become broody should be kept broody by setting a few china eggs under them until such time as eggs from the breeders come in. Broody hens at this time and for the next five months are valuable.

During the rainy season the scratching litter must be kept dry; if it gets wet it is useless.

Duck hatching can be continued all the year round; the main points are that the young ducks must be kept out of the sun and sleep on dry grass. Nothing is more fatal to ducklings than sun, and dampness at night; and the latter applies, too, to the adults. Unless a dry shed, with a dry, soft layer of chaff or sand, etc., covering the floor of it, is available, it is not wise to hatch turkeys till after the wet season is finished, for it will be labour, food and eggs wasted. If the young turkeys get wet they are almost certain to die. This and the feeding on wet mashes instead of dry food, chopped onions and thick milk are the chief reasons for non-success in the breeding of turkeys.

STOCK.

Cattle.—The recommendations for December apply equally to this month. Be careful that the condition of the bulls is maintained, especially in the case of well-bred animals. A bull in poor condition cannot be expected to sire a large number of calves. As far as practicable cut veld hay during this month. Usually the optimum relation of yield and composition occurs now. During this month, in addition to maize, some protein concentrate such as peanut cake or cotton-cake will generally be necessary in the dairy cow mixture to keep up a good milk flow. Increase the grain ration to bullocks which are being fattened on grass and add some protein concentrate to their feed to make good the deficiency of this nutrient in the grazing.

Sheep.—Continue as recommended for December. If heavy rains are experienced, a daily ration of half a pound of maize per ewe will help to keep them in condition. Those who favour autumn lambs must put the ram again with the flock in February, and should take steps to supply a little extra feed to fit the ewes for mating. Start putting in green feed for ewes due to lamb in April or May.

DAIRYING.

This is normally the flush season as far as dairy produce is concerned; dairy cattle are usually in good condition, and cows of average capacity should be able to subsist and maintain a full flow of milk on veld grazing alone. Calves may be given a few hours' exercise on bright, sunny days; young stock, however, should not be allowed to run and graze with the herd, and are best kept in a cool, airy pen opening on to a small shady paddock where they can obtain a little exercise.

A good quality of sweet hay and water should always be available for young calves.

Cream deteriorates very rapidly under the conditions which obtain at this time of the year, so that every precaution should be taken to keep the cream as cool as possible pending despatch to the creamery. As there is a greater strain than usual on the separator during the flush months, frequent oiling is necessary, and care should be taken that the machine is mounted on a level foundation. The separator and all other dairy utensils must be cleaned immediately after use. First rinse the utensils with cool or lukewarm water, then wash thoroughly with boiling hot water, washing soda and a scrubbing brush; scald finally with boiling water.

The cheese in the storeroom is apt to develop mould during wet weather. If the cheese is well made and pressed and has a smooth rind, this mould is merely superficial and will not penetrate into the body of the cheese. Rubbing the cheese with a cloth moistened with a weak solution of formalin or permanganate of potash usually checks the development of mould. During these months care must be taken not to use over-acid milk for cheese-making, and great care should also be taken of the starter. If this latter shows any signs of gasiness or develops any disagreeable flavour or odour, it should be discarded and replaced by a fresh, clean starter. The cheese storeroom must be kept dark and flies excluded.

TOBACCO.

The early tobacco should now be ready for curing. Care should be taken to select only thoroughly ripe leaf for filling the barns, so that the cured product will be uniform. Topping, priming and suckering should be given attention. Selected seed plants should be carefully watched. New land intended for tobacco next year should be ploughed this month, so that all organic matter turned under may be converted into humus before planting time next season.

WEATHER.

This is often the wettest month of the year, with marked differences of from 10 inches to 15 inches on the eastern mountain ranges, 7½ inches over Mashonaland, 4 inches to 6 inches in Matabeleland, and least, but still some, rains in the Limpopo Valley. The rains may be expected to decrease in intensity after the middle of the month if the season is normal.

March.

BEE-KEEPING.

As the latter end of this month should herald the approach of the second and last real honey flow of the season, see that enough extra supers are ready for placing on hives as required, watching also that the fully drawn out combs of shallow frames that are on hand to fill them with are kept free from the wax moth; further, examine all supers that are already on the hives for this serious defect, though strong colonies will as a rule keep the combs free from this pest. March being usually a hot month, look well to the entrance; enlarge when and where necessary, and have ventilating lids on the tops of each hive. Extra ventilation can be provided for when required by placing small metal or wooden wedges underneath the top super, but not to be open enough to let out or in a single bee. Where quilts are noticed to have been eaten or more or less destroyed during the summer months, now is the time to make fresh ones so as to be ready for the closing down and the making snug of each hive when winter approaches; old flour bags or old deck chair canvas make capital quilts. Bees during this month will consume a quantity of water; see that some is always kept in the apiary in floating cork chips. This will save much labour and flight for them, as well as prolong their period of work and usefulness. As stated in last month's notes, flying swarms may be expected now any day, so prepare for their capture if required by having all details and items ready for immediate use. It is as well, however, at this date of the season to do without such swarms, unless the owner is prepared to feed them well during the winter months. March or April swarms, unless they are hived under conditions of providing all the frames, of fully drawn out old combs, do not as a rule have either the time or materials to provide for a strong colony before the winter sets in, and must perforce remain a weak one during that period. The axiom of every bee-keeper should be to let his colonies go into winter quarters brimming over with bees, not only to provide against the mortality that is bound to occur then, but to have a full hive to start the next season with.

CITRUS FRUITS.

Two thorough sprayings about this season, when the rains are usually practically over, at an interval of about two weeks, will often obviate the necessity for further work against scale insects until the beginning of the next wet season. If not already done, orchards should be ploughed and cross-ploughed and worked up into a really good surface, so that the cultivators can be kept going, say, every two weeks until it is necessary to irrigate, after which cultivation should be continued. If March prove a dry month, orange trees holding up a crop of fruit will probably require irrigation, but under normal weather conditions it should not be necessary. The same remarks apply as last month with regard to fruit moths. About the end of this month fall budding can be taken in hand, that is the insertion

of buds that are intended to remain dormant until spring. This applies to higher altitudes, but in low country, where the growing season is extended, dormant budding should not be done until latter end of April.

CROPS.

Watch oats for rust, and, if badly infested, cut crop for hay as soon as weather permits. Ridge late potatoes, and if weather is dry prevent ridges from cracking, to check tuber moth infestation. Finish ploughing under all green manure crops while the ground is still moist enough to promote rapid decomposition. Late in the month begin to cut silage crops and ensile. Cut out barren maize plants and feed to stock or ensile. Cut Sudan grass for hay to permit of final late growth for autumn grazing. Reap any crops that are ready, and plough the stubbles **at once.** Lift ground nuts that are sufficiently matured. Watch for ground nuts making second growth; reap, and when sufficiently dry, place in cocks with nuts inwards and cover the top securely. Sow onion seed beds for winter crop. Watch the weather for hay-making and take advantage of fine spells. Towards the end of the month hay-making should normally be in full swing. Continue to plough all lands in succession immediately the crops are reaped from them. Vleis and irrigable lands should now be ready, or in process of being prepared, for winter crops. Early sowings of Algerian oats, barley or rye for green forage can be made. Allow any potatoes lifted to dry before storing them, but do not leave too long in the sun. Destroy witch weed and other noxious weeds. Continue to make all the kraal manure possible by throwing grass and litter into kraals, yards, etc. Begin to select in the field maize plants for seed purposes, and mark them with slips of coloured cloth. Press on with the breaking up of any virgin land which may have been stumped or cleared earlier in the year. Place orders for grain bags without delay. Early in the month silage pits should be cleaned out or, where necessary, new pits dug.

ENTOMOLOGICAL.

Maize.—The stalk borers of the second brood may now be found in the stalks, but nothing can be done at this stage. Caterpillars sometimes attack the crop as a sequel to cultivation after grass weeds have made too much growth. The caterpillars attack the crop on account of their more natural food being suddenly destroyed. Prevention and not cure is indicated.

Tobacco.—The crop will by this time mostly have outgrown insect injury, but leaf miners and budworms may be in evidence. The latter are usually destroyed by hand when topping. Any plants affected with stem borer should be removed and destroyed.

Potato.—If ladybird beetles or caterpillars are injurious, spray with arsenate of lead (powder) 1 lb. to 30 gallons of water. Careful hilling should be attended to with the object of preventing and checking tuber moth attack.

Vegetable Garden.—If sawfly attacks plants of the cabbage family dust with Paris green 1 lb., fine sifted slaked lime 20 lbs. Against cabbage louse (aphis) wash plants frequently with a strong spray of water. Destroy blister beetles by hand. Plants of the melon family may be baited regularly with arsenate of lead (powder) 1½ ozs., treacle ½ gallon (or cheapest sugar 2½ lbs.), water 4 gallons, to keep down fruit flies. For leaf-eating caterpillars and beetles, etc., spray with arsenate of lead (powder) 1 lb. in 30 gallons of water on foliage which will retain water. Cabbages are best dusted.

Citrus Trees.—Collect and destroy infested fruit to keep down citrus codling. Fruit-piercing moths sometimes attack the fruit during the month, especially navels. They work at night and can only be dealt with at present by hand destruction. The trees should be watched for development of aphis and soft brown scale on the young growth and prompt measures taken. Resin wash at two-thirds standard strength is suitable.

Mosquitoes, House Flies, etc., may be very prevalent during March. Destroy breeding places. Poison or trap adult flies. Attend to screening of residence.

FLOWER GARDEN.

Flower seedlings for winter blooming should now be coming on, and should be planted out during showery or cloudy weather. Cuttings of carnations may now be made, and should be taken from selected plants which have borne the choicest blooms. The cuttings should be dibbled in half paraffin tins containing three parts sand to one of loam, and kept in a moist condition in a shady position sheltered from the winds. Make main sowing of winter-flowering sweet peas in a well-prepared and rich soil.

VEGETABLE GARDEN.

The sowing calendar is the same as that recommended for last month. Plant out from seed beds cabbage and cauliflower; care should be taken during this month, as the end of the rainy season approaches, to dig with a fork all the ground in the garden. The heavy rains settle this down hard, and as soon as the dry weather begins the soil cracks and lets out all the sub-soil moisture by evaporation. As soon as the rains cease entirely it is advisable to go over the ground and fine down with a rake, leaving some three or four inches of quite fine soil to act as an earth mulch.

FORESTRY.

Cultivation where necessary should be undertaken between the rows of trees planted out in previous months. If cultivation is carried out with the hoe, care should be taken not to pile earth round the base of the stems. New ground for next season's planting should be roughly broken up with the plough. Bulk plantings may be proceeded with during the month.

GENERAL.

At this time the condition of stock on the veld is usually good. It is well, however, to look ahead and make ready for the coming winter by the provision of winter feed in such forms as veld hay, silage, baled fodder from maize, manna, oats, teff, velvet beans, and the like, and by taking steps to ensure that water will be available for the stock in winter as near their grazing ground as may be.

POULTRY.

The breeding pens should have all been mated up by now, as the first chicks should be out by the beginning of April. Much more care should be used than is usually the case when selecting birds for breeding. Only the very best, i.e., the strong, healthy, vigorous ones from the best layers, should be chosen. A pamphlet on "Selection and Mating for Improvement" can be obtained on application to the Editor or the Poultry Experts. This deals fully with the subject. Always keep an eye on the male bird; many are apt to get thin and run down in health, due to their allowing their mates to eat all the food. Such birds are better breeders than those that chase their mates away from the food. Every male that is being bred from should be given a good meal by himself each day, to ensure health and vigour. The incubator should be thoroughly overhauled, cleaned and disinfected before the eggs are put in.

STOCK.

Cattle.—Arrangements for winter feed should be pushed on. For a well balanced winter ration, in addition to good quality veld hay, a succulent feed such as maize silage, majordas or pumpkins and a legume hay such as velvet beans, cowpeas or dolichos beans are essential. The milk supply will begin to decrease. In the case of cows rearing calves it is often good policy in this month to cease milking the cows and to allow the calves to get all the milk from now on. Slightly increase the amount

of grain to the dairy cows and increase the proportion of protein concentrate in the dairy cow mixture to make good the usual loss of feeding value in the grass. Bullocks fattening on grass will do better for a daily ration of some succulent feed such as green mealies or sweet potato tops.

Sheep.—Grass seed may be very troublesome. Keep the sheep on short grazing, or, alternatively, put them on to grazing which has been mown. Crutch the ewes due to lamb.

DAIRYING.

This is usually the most favourable month of the year for dairy operations. Cooler nights are now in evidence, and there is usually little difficulty in maintaining a low temperature in the dairy and cheese-room. If elementary precautions are taken, all cream should be first grade, and first-class cheese should be made, as a gassy condition of the milk is rare. Dairy cows, unless they are very high producers, can go without extra rations, because the grass is now in seed and grazing is ample. The cheese storeroom is generally full of cheese, and care should be taken to turn the cheese regularly. The windows and doors should be opened at night and closed in the daytime. A little mould on the cheese will not affect its quality, but if the mould is excessive the cheese should be rubbed daily.

Calves which are under four months old should be kept in and allowed to nibble at well-got hay; at the same time a little dry mealie meal and monkey nut cake will do them good and teach them to eat concentrates. An ample supply of clean water should be provided in the calf run.

TOBACCO.

All late plants should be topped low to hasten maturity. The bales of cured leaf should be examined to ascertain whether or not the tobacco has been baled in proper condition. Seed heads should receive continued care. Land ploughed during February should be disced and rolled to assist the decomposition of organic matter. Tobacco fields already cleared of plants should be immediately ploughed. Tobacco bulks should be examined and turned, if necessary.

WEATHER.

Rains may be looked for in considerable quantity, though less than in previous months, 5 inches in Mashonaland and 3 inches in Matabeleland being normal, with as usual more on the eastern frontier. No useful rain need be reckoned upon after the end of this month, except on the eastern border, but the rainy season tapers off in an irregular and often erratic manner and without certainty.

SOUTHERN RHODESIA VETERINARY REPORT.

November, 1932.

AFRICAN COAST FEVER.

Melsetter District.—No fresh outbreaks. All previously infected herds are now on clean veld.

FOOT AND MOUTH DISEASE.

Gwanda District.—No fresh outbreaks. The results of the inoculation carried out on the farms Timber and Deneys during the month of October were somewhat unsatisfactory. For several weeks after the completion of the inoculation, fresh cases of infection kept occurring, but these had ceased before the end of November.

Gwelo District.—No fresh outbreaks. Amongst the cattle inoculated on Goldfields South during October several cases of delayed infection occurred, as at the Gwanda centre, necessitating a prolonged period of quarantine before returning the herds to their respective owners. At the Bembezaan and Central Homestead sections of the Rhodesdale Estate the reactions to inoculation were most satisfactory, and towards the end of the month most of the herds had been returned to their respective owners.

EPHEMERAL FEVER: THREE DAYS' SICKNESS OF CATTLE.

The onset of the rains was marked by numerous cases of this disease in the central section of the Melsetter district.

IMPORTATIONS.

From the Union of South Africa and Bechuanaland Protectorate: Bulls, 1; heifers, 10; horses, 4; sheep, 1,142; goats, 70; pigs, 12.

EXPORTATIONS.

Chilled Beef to England: Forequarters, 152; hindquarters, 147.

J. M. SINCLAIR,
Chief Veterinary Surgeon.

SALES.

AGRICULTURAL EXPERIMENT STATION, SALISBURY.

Spineless Cactus Slabs (blades) Algerian variety, per 100 slabs, 7/6 Salisbury, or 12/6 delivered free by rail to purchaser's nearest station or siding in Southern Rhodesia. For amounts of 500 slabs or more a reduction of 2/6 per 100 will be made.

Stocks are limited and delivery cannot be undertaken after 15th November.

Kudzu Vine Crowns, per 100 crowns, 15/-, Salisbury, or 25 crowns, 7/6; 50 crowns, 15/- and 100 crowns, 22/6, delivered free to purchaser's nearest station or siding in Southern Rhodesia. Delivery during September and October for irrigated land, and in January for dry land. Owing to pressure of other operations, it is not possible to deliver Kudzu crowns during November and December.

Woolley Finger Grass: 10s. per bag of roots, delivered on rail nearest station or siding; supplies limited. Available January and February.

The prices quoted above do not include charges for road motor transport. Cheques should be made payable to the Department of Agriculture, and preliminary enquiries and subsequent orders should be addressed to the Chief, Division of Plant Industry, Department of Agriculture, Salisbury.

SOUTHERN RHODESIA WEATHER BUREAU.

DECEMBER, 1932.

Pressure.—Mean barometric pressure was generally about normal. Umtali was lowest with 0.4 mbs. below normal and Victoria highest with 0.5 mbs. above normal.

A weak high appeared off the west coast on the 4th. The second high appeared on the west coast on the 11th, and was central near Southern Rhodesia from the 13th to the 15th. The third high appeared on the 17th, but did not approach. The fourth appeared on the south-east coast on the 20th, and was central on the 21st; the fifth also appeared on the south-east coast on the 23rd and was central on the 25th. The sixth high was on the south and south-east coasts on the 27th to the 29th, and the seventh appeared on the south coast on the 30th. The second high was associated with a fall off in rainfall, but the remainder never moved far enough north to affect conditions in Southern Rhodesia.

The equatorial low was central in the Union from the 1st to the 3rd, and then moved to the south-east coast and withdrew. A southerly low appeared on the south-west coast on the 6th and moved to the south-east coast and faded. From the 12th to the end of the month, the equatorial low maintained a continuous activity, and the normal high pressure in the Mocambique Channel was replaced by extensions of the equatorial low.

Temperature.—Mean temperatures were generally slightly below normal.

Rainfall.—The rainfall for December from telegraphic reports amounted to 9.2 inches—roughly 3.6 inches above normal. The total since the 1st October amounts to 11.9 inches, or 2.0 inches above normal.

DECEMBER, 1932.

Station.	Pressure Millibars, 8.30 a.m.		Temperature in Stevenson Screen ° F.								Rel. Hum.	Dew Point	Cloud Amt.	Precipitation.			Altitude (Feet).
			Absolute.		Mean.												
	Mean.	Normal.	Max.	Min.	Max.	Min.	½ Max. Min.	Normal.	Dry Bulb.	Wet Bulb.	%	F.	0-10	Ins.	Normal.	No. of Days.	
Bulawayo ...	867.5	867.2	89	57	80·4	61.6	71 0	71.7	69.9	63.0	68	59	7.0	6.39	5.2	15	4,436
Gwelo	861.4	...	89	55	79.0	60.3	69.7	71.9	67.9	62.8	75	60	7.0	8.90	6.0	19	4,632
Riverbank ...	...	...	94	57	83.0	63.4	73.2	74.8	72.1	65.1	69	61	...	5.39	5.8	14	4,100
Essexvale ...	...	...	97	61	84.3	64.5	74.4	74.6	71.2	65.5	75	63	...	10.60	5.4	14	3,828
Gwanda ...	904.4	...	94	57	83.4	64.5	73.9	...	73.6	65.8	66	62	5.4	...	4.6	...	3,235
Mazunga ...	946.1	946.6	102	57	89.0	66.6	77.8	78.4	76.4	...	...	...	5.8	1.89	3.7	9	1,970
Nuanetsi ...	...	...	101	54	89.1	67.5	78.3	...	76.4	70.0	72	67	6.2	2.31	3.3	12	1,630
Between Rivers	...	...	89	59	82.3	63.1	72.7	...	70.3	65.6	78	64	7.1	10.27	6.8	21	3,970
Enkeldoorn ...	856.4	...	86	55	78.0	60.2	69.1	70.7	69.4	63.7	73	60	7.2	8.22	6.5	18	4,720
Gatooma ...	...	...	92	59	83.2	62.4	72.8	74.2	71.1	65.7	75	63	7.1	10.65	6.9	18	3,850
Miami	877.3	...	88	60	79.5	63.3	71.4	...	69.4	65.2	81	63	7.2	13.10	5.9	24	4,090
Salisbury ...	853.8	853.9	83	56	77.2	60.6	68.9	63.6	68.3	63.1	75	60	8.2	6.90	6.7	22	4,890
Sinoia ...	...	...	...	...	...	...	...	...	...	...	...	...	...	12.44	6.8	19	3,804
Sipolilo... ...	...	...	88	61	79.5	64.2	71.9	...	71.1	65.3	72	62	6.4	12.56	6.1	19	3,900
Mtoko	...	...	...	...	...	...	...	...	...	...	...	...	...	...	6.6	...	4,210
Bindura ...	...	...	88	61	78.9	63.8	71.4	...	69.7	65.5	80	63	7.3	14.25	6.5	24	...
Angus Ranch ...	...	...	95	63	86.6	68.7	77.6	78.3	75.7	70.2	76	67	...	6.76	4.6	19	2,300
Craigendoran ...	...	...	96	57	83.6	62.9	73.3	...	74.3	68.1	73	65	...	7.07	7.4	17	3,410
New Year's Gift	...	...	89	59	82.7	63.8	73.3	...	72.0	66.7	76	64	...	9.82	5.9	19	2,700
Nyamasanga ...	...	...	82	52	75.4	58.5	66.9	...	68.3	63.2	76	60	...	...	...	...	5,080
Riverdene North	...	...	93	56	83.1	62.3	72.7	...	69.8	65.7	81	64	...	9.26	5.0	19	3,700
Stapleford ...	...	...	74	52	68.7	55.9	62.3	...	64.1	61.8	88	60	7.5	24.35	6.5	26	5,450
Umtali	891.5	891.9	88	57	79.5	63.0	71.3	71.9	70.7	66.0	79	64	6.7	10.80	4.8	20	3,677
Victoria ...	894.3	893.8	90	57	81.0	63.1	72.0	73.0	71.1	65.4	74	62	6.6	10.82	5.2	18	3,570
Melsetter ...	849.5	...	80	52	74.2	58.2	66.2	...	67.1	61.9	75	59	5.4	12.89	7.7	19	5,060
Mount Selinda	...	...	86	56	76.2	62.5	69.3	...	68.1	65.2	85	63	6.8	14.24	8.9	22	3,520
Manchester ...	...	...	76	50	71.3	51.7	61.5	...	61.5	59.9	91	59	...	15.03	...	25	...

Rainfall, December, 1932, in Hundredths of an Inch. Telegraphic Reports.

a	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Total.
	52	50	52	160	79	41	59	21	85	...	...	1	...	...	...	...	1	...	...	5	...	12	...	...	1	76	26	...	...	16	21	698
	27	59	53	54	59	39	48	18	58	...	...	14	...	...	...	...	7	1	10	106	3	...	...	...	8	145	91	27	...	15	68	910
	...	41	144	1	321	1	...	151	5	5	...	29	40	17	65	...	21	23	51	109	8	...	12	19	...	21	318	90	12	2	15	1,521
	43	28	53	42	81	54	30	6	47	17	...	...	3	...	...	...	27	4	...	45	29	22	10	...	16	196	105	6	...	76	93	1,033
	53	11	13	33	50	5	58	4	52	...	...	...	4	...	...	...	61	...	...	16	...	39	22	41	36	65	15	...	...	57	20	655
	24	11	64	...	40	69	...	2	9	2	...	...	...	...	...	10	67	29	28	2	4	5	32	5	38	7	69	...	...	135	211	863
	8	8	124	1	23	11	8	66	29	42	32	12	1	5	14	6	16	55	59	81	14	9	19	15	21	7	214	24	7	108	96	1,135
	37	11	96	1	13	7	...	3	12	90	39	...	9	14	4	46	81	1	49	60	17	33	46	12	59	24	84	11	35	82	117	1,093
	61	11	76	...	71	18	7	17	1	14	...	1	2	1	24	49	90	...	14	79	16	92	32	7	4	53	48	81	140	79	136	1,160
	62	...	40	107	...	...	...	...	72	264	...	1	...	...	...	...	134	...	1	20	44	...	79	36	44	38	9	49	65	13	173	1,206
n	43	26	59	42	49	27	33	19	43	25	5	4	2	1	6	10	43	8	13	47	10	27	19	13	18	75	69	23	26	56	80	921

DEPARTMENTAL BULLETINS.

The following Bulletins, consisting of reprints of articles which have appeared in this Journal, are available for distribution at 3d. per copy. Application should be made to the Editor, Department of Agriculture, Salisbury, and remittances must accompany orders.

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No. 374. Fibre Crops—Deccan Hemp (Hibiscus Cannabinus) and Sunn Hemp (Crotolaria Juncea), by J. A. T. Walters, B.A.

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No. 697. Results of Analysis of Samples taken under the "Fertilisers, Farm Foods, Seeds and Pest Remedies Ordinance" during the year 1927-28.

No. 704. The Importance of Research on Pasture Improvement in Southern Rhodesia, by A. D. Husband, A.I.C., Chief Chemist.

No. 705. Suggested Cropping Programmes for Farms on the Sand Veld, by D. E. McLoughlin, Assistant Agriculturist.

No. 706. A Farmers' Calendar of Crop Sowings, by C. Mainwaring, Agriculturist.

No. 709. Sand Veld Farming and its Possibilities, by E. D. Alvord, M.Sc. (Agr.).

No. 710. Monthly Reminders for the Farming Year, by the Division of the Chief Agriculturist.
No. 713. Ensilage, by J. A. T. Walters, B.A., Agriculturist.
No. 727. Farmyard Manure, by A. P. Taylor, M.A., B.Sc., Agricultural Chemist.
No. 732. Two Common Diseases of Potato Tubers in Rhodesia, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A.
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No. 759. Witch Weed (Striga Lutea): Methods of Control, by S. D. Timson, M.C., Dip.Agric. (Wye).
No. 762. The Value of Rock Phosphate and "Bone and Superphosphate" as Fertilisers for Maize Production, by A. D. Husband, Chief Chemist.
No. 768. The Ground Nut (Arachis hypogaea), by S. D. Timson, M.C., Dip.Agric. (Wye).
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No. 776. Regulations Governing the Export of Maize and Maize Meal through the Port of Beira.
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No. 867. Agricultural Statistics for the Season 1930-31: (a) Live Stock; (b) Crops Grown by Europeans in Southern Rhodesia, compiled by the Government Statistician.

REPORTS ON CROP EXPERIMENTS.

No. 608. Annual Report of Experiments, 1924-25, Agricultural Experiment Station, Salisbury, by H. G. Mundy, Dip.Agric., F.L.S.
No. 631. Bulawayo Experiment Station: Annual Report for Year 1925-26, by H. W. Hilliard.
No. 649. Annual Report of Experiments, 1925-26, Agricultural Experiment Station, Salisbury, by H. C. Arnold, Manager.
No. 675. Bulawayo Experiment Station—Annual Report for Year 1926-27, by D. E. McLoughlin.
No. 683. Annual Report of Experiments, 1926-27, Agricultural Experiment Station, Salisbury, by H. C. Arnold, Station Manager.
No. 688. Report, 1923-24—1926-27, Gwelo Municipal Demonstration Stations, by D. E. McLoughlin.
No. 716. Report, 1927-28, Gwelo Municipality Demonstration Stations, by S. D. Timson, M.C., Dip.Agric.
No. 745. Salisbury Agricultural Experiment Station Annual Report, 1927-28, by H. C. Arnold.
No. 773. Bulawayo Municipal Demonstration Station: Report for the Seasons 1927-28 and 1928-29, by D. E. McLoughlin, Assistant Agriculturist.
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No. 806. Gwebi Demonstration Farm, by the Chief Agriculturist.
No. 810. Gwelo Municipal Demonstration Station: Annual Report, 1929-30, by S. D. Timson, M.C., Inter.B.Sc. (Agric.) Lond., Dip.Agric. (Wye), Assistant Agriculturist.
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No. 842. Gwelo Municipal Demonstration Station: Annual Report, 1930-31, by D. E. McLoughlin, Assistant Agriculturist.
No. 851. Bulawayo Municipal Demonstration Station: Final Report, 1932, by D. E. McLaughlin, Assistant Agriculturist.
No. 864. Annual Report, 1930-31: Agricultural Experiment Station, by H. C. Arnold, Station Manager.

TOBACCO.

No. 605. Flue-curing Tobacco Barns, Bulking and Grading Sheds, by P. H. Haviland, B.Sc. (Eng.), Acting Government Irrigation Engineer.
No. 615. The Culture of Virginia Tobacco in Southern Rhodesia—Field Management, by D. D. Brown.
No. 641. The Handling, Grading and Baling of Cured Virginia Tobacco, by D. D. Brown.
No. 644. Tobacco Baling Boxes, by B. G. Gundry, Irrigation Branch.

No. 653. The Care of Tobacco Seed Beds, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A. (Trinidad).
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No. 665. Tobacco Pests of Rhodesia, by Rupert W. Jack, F.E.S., Chief Entomologist.
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No. 840. Curing Tobacco by the Leaf Method *v.* Curing on the Stalk, by W. Collingwood-Evans, B.Sc. (Agr.).
No. 846. Leaf Curl in Tobacco, by Dr. H. H. Storey.
No. 850. Pests of Stored Tobacco in Southern Rhodesia, by M. C. Mossop, M.Sc., Entomologist.

Handbook of Tobacco Diseases in Southern Rhodesia, by J. C. F. Hopkins, B.Sc., A.I.C.T.A. Price 3/6 post free from Accountant, Department of Agriculture, Salisbury.

LIVE STOCK.

No. 338. From Breeder to Butcher; Beef Experiment No. 5, by E. A. Nobbs, Ph.D., B.Sc.
No. 381. From Breeder to Butcher; Cattle Feeding Experiment No. 8, by Eric A. Nobbs, Ph.D., B.Sc.
No. 421. From Breeder to Butcher; Cattle Feeding Experiment No. 9, Government Experiment Farm, Gwebi, by E. A. Nobbs, Ph.D., B.Sc., F.H.A.S.
No. 446. From Breeder to Butcher; Cattle Feeding Experiment No. 11, Government Experiment Farm, Gwebi, by Eric A. Nobbs, Ph.D., B.Sc., F.H.A.S.
No. 468. From Breeder to Butcher; Cattle Feeding Experiment No. 13, by Eric A. Nobbs, Ph.D., B.Sc.
No. 483. From Breeder to Butcher; Cattle Feeding Experiments Nos. 14 and 15, Government Experiment Farm, Gwebi, by Eric A. Nobbs, Ph.D., B.Sc.
No. 624. The Construction of Dipping Tanks for Cattle (Revised).

No. 701. Feeding Bullocks at Gwebi, by S. D. Timson, M.C., Dip.Agric.
No. 719. Hand-rearing of Calves (Revised), by T. Hamilton, M.A., N.D.A., N.D.D., Dairy Expert.
No. 720. Fattening for Beef at the Gwebi Farm, by H. G. Mundy, Chief Agriculturist, and T. J. Needham, Accountant, Agricultural and Veterinary Departments.
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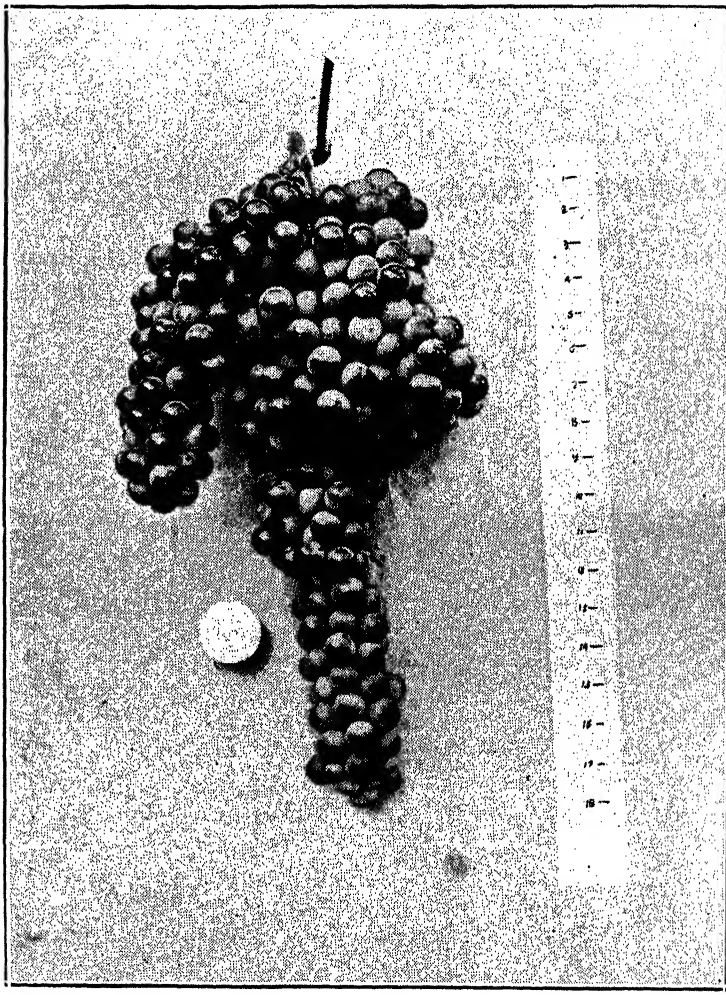

A fine bunch of Barbarrosa grapes.

THE RHODESIA

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EDITORIAL.

Contributions and correspondence regarding subjects affecting the farming industry of Southern Rhodesia are invited. All communications regarding these matters and advertisements should be addressed to:—The Editor, Department of Agriculture, Salisbury.

Barbarossa Grapes.—The frontispiece to this issue depicts a bunch of Barbarossa grapes grown by Mr. H. G. Wheeldon, Chief Poultry Officer of the Department of Agriculture, at his residence in Montagu Avenue, Salisbury. The length of the bunch was 17 inches, width across broadest part 10 inches and weight 5 lbs.

This is possibly a record for Southern Rhodesia. The vine is 7-8 years old and is growing close to the back verandah of the house, with a southern aspect. It has never been specially manured or dressed with fertiliser but benefits from manurial and cultural treatment applied to garden flowers grown about its base.

The crop this season consisted of about 35 bunches, all of large size and estimated to weigh on an average 2-3 lbs. The fruits were large, sweet, of full flavour and with a plentiful bloom as may be judged from the illustration.

Tobacco Production.—The Hon. J. W. Downie, High Commissioner for Southern Rhodesia, submits the following information concerning the marketing of Southern Rhodesia tobacco in the United Kingdom during the year ending 31st December, 1932:—

The quantity of Southern Rhodesia tobacco imported into the United Kingdom amounted to 10,309,000 lbs. Withdrawals for home consumption (including re-exports) totalled 7,884,000 lbs. The balance, approximately 2,500,000 lbs., remains in bond and consequently the available stocks of Southern Rhodesia tobacco in bonded warehouses are thereby increased by roughly 2½ million lbs.

Figures for the last three months would indicate that the consumption of Southern Rhodesia tobacco in the United Kingdom during the year 1933 will reach somewhere around the 10,000,000 lbs. mark. Increased consumption will no doubt lead to additional purchases being made by manufacturers for the purpose of building up their stocks. Nevertheless, the estimated crop for 1933, if realised, is too high and if the policy of increasing production so far in advance of requirements is persisted in then the results must also be detrimental to the growers and the industry. Dark fire-cured tobacco does not appear to have come up to early expectations of the manufacturers, thus necessitating a cautious policy on the part of the growers. In flue-cured a higher proportion of medium and higher quality bright grades should be aimed at, as it is considered that too big a proportion of low grade and dark leaf finds its way to the United Kingdom.

Rhodes Matopo Estate Bursaries, 1933.—Applications are invited for a limited number of bursaries available for students wishing to take the diploma course at the Matopo School of Agriculture.

The bursaries cover boarding and tuition fees (£48 p.a.) either wholly or in part and are tenable for one or two years, commencing from the beginning of the first term, 1933 (16th January).

Applicants must have passed at least the Junior Certificate examination or its equivalent, and must, if successful, supply before being admitted to the school a medical certificate that they are able to carry out a full year's course of practical work in agriculture.

Bursaries will not be made available for students whose parents are in a position to pay the ordinary fees, and assistance will only be granted to those students who, though qualified, would otherwise be debarred from taking the diploma course.

For further particulars and application forms apply to The Director, Matopo School of Agriculture, Private Bag 19 K, Bulawayo.

Tobacco Pests Suppression Act.—It is the Government's intention to introduce a Bill during the next session of the Legislative Assembly to take the place of the Tobacco Pests Suppression Act, 1931.

This step has been taken on the recommendations of the Rhodesia Tobacco Association to the effect that the scope of the Act should be extended, firstly to bring under control, in respect to suppression of pests of cured tobacco, all tobacco farms throughout the Colony, and secondly to admit of measures being enforced for the control of certain pests of growing tobacco.

With regard to the first recommendation it has appeared only equitable that if the central exporting warehouses are to be subject to restrictions enforcing strict cleanliness in respect to such pests as "Stored Tobacco Worm" (*Ephestia elutella*, Hubn.) and the Tobacco Beetle (*Lasioderma serricorne*, Fab.) protection should be afforded against the danger of introduction of these pests to the warehouses with tobacco from the farms.

All tobacco farmers will, therefore, be required to adopt measures to ensure the same degree of cleanliness as is now enforced in the exporting warehouses, and in this connection it may be stated that provision is being made for inspection of all tobacco farms annually.

With regard to the second recommendation this refers at present only to the Tobacco Whitefly (*Aleyrodidae*) which has been shown to transmit the disease, long known in this Colony as "Frenching," but now generally referred to as "Tobacco Leaf Curl."

There are indications of serious increase of this disease in the Colony and it is judged that this tendency can only be checked by concerted action on the part of growers.

To secure uniform concerted action legislation is unavoidable.

The measure it is at present intended to enforce is the destruction of all tobacco plants by a date to be fixed by regulation. The Bill, however, confers powers on the Governor to make regulations in respect to the enforcing of other measures should this prove to be necessary or desirable, though such powers would, normally, only be exercised in close consultation with representatives of the tobacco growing industry.

Improved Strains of Grasses.—An interesting reflection to the editorial on this subject which appeared in our last issue is provided by a report in the *Farmers' Weekly* for the 11th January, in which are described by Mr. R. Lindsay Robb, Chief Grassland Adviser to Imperial Chemical Industries, Ltd., London, experimental grass plots maintained by Mr. Howard Hobson on his farm Pinekloof, Ladybrand District, Orange Free State.

It appears that in various sowings of cocksfoot made by Mr. Hobson some years ago, a single plant was noticed to possess superlative characteristics. Seed of this strain was collected and several acres of it have now been developed.

Mr. Lindsay Robb, whose experience of grass strains and types is possibly unique, is reported as describing this particular cocksfoot as "the most promising in the world," on account of it having apparently all the most desirable features of a pasture grass combined with a remarkable capacity to withstand drought and heavy grazing.

It seems that Mr. Hobson is carrying out in the Orange Free State similar grass experiments as were suggested to Rhodesian farmers in our last issue. His plots include various strains of Woolly Finger grass, as well as Rhodes grass, Rescue grass, native *Setarias* and *Panicums* and so forth.

The discovery of this strain of cocksfoot by Mr. Hobson serves to indicate the manner in which the individual—apart from his other farming occupations—can assist himself and his fellow farmers to augment the work of Government Departments of Agriculture and other research institutions.

Proposed Tobacco Levy.—As a result of representations, made by the tobacco producers, it is proposed to introduce a levy on all unmanufactured tobacco produced in this Colony. The Tobacco Levy Bill will be submitted to the Legislative Assembly during the forthcoming session. The proceeds of the levy are to be used in the furtherance of the interests of the tobacco industry and it is intended that the funds collected will be expended mainly on such items as scientific and economic research, publicity work and exploration of new markets. All expenditure hitherto involved in assisting the tobacco industry has been provided by Government. The proposed measure for raising a fund through the agency of a levy is a practical expression of the desire of tobacco growers towards self help. This is a healthy sign and producers are deserving of full credit for their efforts and for the decision arrived at. It is believed that the proceeds of the levy will, in addition to any other financial aid which may be available, materially assist in establishing the tobacco industry on a sound basis.

Impending Visit of Publicity Officer.—Arrangements have been made for Mr. A. J. Bouchier, Publicity Officer attached to the High Commissioner's staff in London, to visit Rhodesia very shortly.

Mr. Bouchier has been stationed in England for about five years and has been responsible for much of the excellent publicity work carried on from the office of the High Commissioner.

It is felt advisable for him to re-visit Rhodesia and bring himself up-to-date with the progress of production of our various commodities.

Mr. Bouchier is expected to reach Salisbury about the end of March, and producer organisations and others interested in export trade are invited to communicate with the Department of Agriculture in order that a suitable itinerary for Mr. Bouchier may be arranged.

Good Farming Rewarded.—Systematic green manuring combined with the judicious use of phosphatic fertilisers—principally raw rock phosphate—and the application to other fields of as much farm manure as could be made: these were the principles upon which the arable land of the Gwebi farm was worked during recent years whilst the farm was conducted as a commercial unit.

By these means a steady improvement in crop yields—making due allowance for vagaries of season—was gradually being achieved, which culminated in the following maize returns for the season 1931-32: from 510 acres of maize on the section leased to Mr. A. N. Gilchrist, 7,178 bags, or an average of 14 bags an acre; from the 130 acres of maize grown on the portion of the farm still retained by the Government until September, 1932, 1,983 bags—a total of 9,161 bags from 640 acres, or an average of 14.3 bags an acre. This constituted a record for the farm both in total production of maize and in average yield per acre, and may be compared with the following returns, the first six of which were quoted in the Journal of February, 1931:—

Average maize yield,	1925; 345	acres:	9	bags per acre
,, ,, ,,	1926; 340	,,	9.7	,, ,, ,,
,, ,, ,,	1927; 332	,,	11.0	,, ,, ,,
,, ,, ,,	1928; 412	,,	11.6	,, ,, ,,
,, ,, ,,	1929; 414	,,	9.06	,, ,, ,,
,, ,, ,,	1930; 467	,,	10.6	,, ,, ,,
,, ,, ,,	1931; 507	,,	10.2	,, ,, ,,
,, ,, ,,	1932; 640	,,	14.3	,, ,, ,,

Advice on Soil Erosion.—The Irrigation Division proposes, as in previous years, to carry out an early series of tours of advice regarding works affecting soil erosion. These tours are made during March and April, and have been found useful by farmers who wish to throw up contour ridges on lands where green manure crops have just been ploughed in. Storm water drains can also often be more cheaply dug at this time of the year, while the soil is still soft from the rains.

It is therefore recommended that individual farmers or Associations should send in their names as early as possible, so that arrangements can be made without waste of time or travelling. Owing to the growing interest in the question of soil erosion and the limited staff to meet the demand for advice, it is in the interest of farmers themselves to avoid concentrating their requests for advice into the last two months of the dry season, if the work can be put in hand at an earlier date. Further tours are usually made in June-July and September to November.

European Farm Employment Registration.—The Rhodesia Agricultural Union, whose offices are at No. 10, Mutual Buildings, Salisbury, have opened a register in which those genuinely seeking farm employment are invited to enrol their names. Employers are asked to make a point of inspecting this register whenever they require an assistant, and every endeavour will be made to place those concerned in touch with each other. Young men wishing to be placed on farms as pupils are also invited to register. No fees are charged.

THE OCCURRENCE OF CHLORINE IN TOBACCO.

By Dr. C. W. B. Arnold, Research Chemist, The Imperial Tobacco Company (of Great Britain and Ireland), Limited, Limbe, Nyasaland.

Introductory.—Tobacco seed has been carried from the U.S.A. to most parts of the world and has adapted itself to its new conditions with more or less success. By careful cultivation and curing, leaf of good appearance has been produced. When the leaf is smoked, subtle differences are noticed in the flavour or aroma from that of leaf grown from the same parent seed in America. These differences may not imply inferiority of the product. The public taste, however, has become accustomed to certain standards since the introduction of tobacco into England in 1586, and public taste changes slowly.

The flavour of tobacco has been attributed to resins by one authority. The resins of tobacco have a strong, unpleasant smell, and may be expected to impress themselves on the senses. The organic acids also emit a distinctive odour when burnt, as also do certain nitrogenous ingredients. Other odourless constituents should not be overlooked, as their relative amounts may play an important part. Their abundance or deficiency may cause abundance or deficiency of the constituents which control aroma or flavour. Further, the odourless constituents may affect the rate of burn and thereby the aroma. The elucidation of the problem of aroma presents great difficulties. The method of approach in our investigations has been to endeavour to produce leaf under African conditions of similar composition to that grown in the U.S.A. When this has been accomplished, one may reasonably expect similar burning qualities and aroma.

Numerous analyses of African and American leaf have been made, and it has constantly appeared that the difference in the chlorine content of the two is very pronounced.

Chlorine in Tobacco.—The amounts of chlorine found in U.S.A. leaf varies between wide limits. In tobacco grown in Africa from American seed (referred to as "African tobacco"), the variations are also great, but the quantities are far smaller.

	Total Chlorine in Dry Leaf. %	Chlorine in Ash. %
American Cigarette Grades.—		
Average of 20 samples	1.79	12.5
Highest	3.06	...
Lowest	0.81	...
American Pipe Grades.—		
Average of 5 samples	1.88	11.32
Highest	2.77	16.25
Lowest	1.47	9.41
Rhodesian Sundry Grades.—		
Average of 11 samples	0.036	...
Highest	0.064	...
Lowest	0.016	...
Rhodesian Cigarette Grades from one Estate.—		
Average of 6 samples	0.29	1.61
Highest	0.38	2.43
Lowest	0.23	1.13
Nyasaland Pipe Grades.—		
Average of 17 samples	0.42	1.85
Highest	0.99	4.87
Lowest	0.05	0.40

The causes underlying these great differences were investigated, and it was thought that there might be considerable differences in the amounts of chlorine present in the respective soils.

Chlorine in Soils.—In the analysis of soils for agricultural purposes, chlorine is not determined, as it is not one of the major plant foods. Such small quantities as are essential for growth are presumed to be present. None of the published analyses showed the percentages of chlorine, and it was necessary therefore to get samples of soil from the tobacco districts of the U.S.A. and to analyse them for this constituent. Such samples were obtained by Mr. F. W. Jollyman, Chief Chemist of the Imperial Tobacco Company.

Other samples were collected from various parts of Rhodesia and Nyasaland and analysed with the results shown below. The so-called "available" phosphoric acid and potash are also given as of interest.

	Total Chlorine.	Soluble in 1% Citric Acid. Phos. Acid.	Potash.
American Soils.—	%	%	%
Districts—			
Winston Salem	0.011	0.027	0.005
South Boston	0.007	0.023	0.003
Danville	0.006	0.021	0.003
Greenville	0.007	0.050	0.004
Mullins	0.003	0.051	0.003
Lynchburg	0.007	0.005	0.009
Rhodesian Soils.—			
Districts—			
Concession	0.003	0.008	0.010
Umvukwe	0.005	0.007	0.009
Inyazura	0.004	0.008	0.009
Shamva 1	0.004	0.004	0.016
Shamva 2	0.005	0.005	0.011
Marandellas	0.004	0.005	0.008
Banket	0.005	0.009	0.009
Sinoia	0.005	0.004	0.013
Hartley	0.006	0.004	0.012
Nyasaland Soils.—			
Districts—			
111 Namwera	0.008	0.024	0.006
184 Zomba Road	0.006	0.022	0.017
194 Mikalongwe 1 ...	0.010	0.037	0.013
199 Mikalongwe 2 ...	0.011	0.065	0.013
211 Zomba	0.017	0.028	0.028
248 Lilongwe	0.004	0.005	0.017

The American soils show about the same chlorine content as the Nyasaland soils, and somewhat higher values than the Rhodesian soils. Such differences as occur in the soils of the three territories did not appear to account for the great differences in the chlorine content of the tobacco produced in them, and the source of the chlorine was sought elsewhere.

Chlorine in Fertiliser Mixtures.—Mr. Paul (I.T.C.) suggested that standard fertiliser mixtures used in the U.S.A.

should be tested for chlorine, and samples were procured and analysed.

Mixture.	Guaranteed Analysis. Phos. Acid.	Ammonia.	Potash.	Cl Found.	Cl in 1,000 lbs.
No. 1	8	4	4	1.34%	13.4
No. 2	8	3	3	1.38%	13.8
No. 3	9	$3\frac{1}{2}$	5	2.12%	21.2
No. 4	8	$3\frac{1}{2}$	5	3.03%	30.3
No. 5	8	3	3	1.98%	19.8
No. 6	8	3	5	1.95%	19.5
No. 7	8	3	5	0.54%	5.4

In the first three mixtures, the sources of potash were stated to be sulphate and muriate of potash; No. 4 was said to contain sulphate, but no statement was made regarding the others. It should be noted that chlorine was found in all cases.

A rough calculation indicates that most of the chlorine in American leaf may be accounted for by the fertiliser.

Dry Matter from 1 *Acre.*—

Leaf	800 lbs.
Stalk and root, etc.	700 lbs.
Total	1,500 lbs.
Chlorine reckoned at 1.8% ...	27 lbs.

Manure.—

1,000 lbs. of 8:3:3 mixture containing 2% of chlorine supplies chlorine	20 lbs.

The manure mixtures used in tropical Africa are highly concentrated with a view to reducing transport charges. Thus, a standard mixture supply nearly the same amounts of the essential plant foods would be 36: 14: 14.5. Compare the following applications:—

	Phos. Acid.	N.	Potash.
U.S.A.—			
1,000 lbs. of 8: 3: 3 supplies	80	25	30
Rhodesian.—			
200 lbs. of 36: 14:14.5 supplies	72	28	29

NOTE.—In U.S.A. manures the nitrogen is calculated to ammonia, and 3 per cent. ammonia is equal to 2.5 per cent. nitrogen.

In compounding the former, low-grade materials are probably used, whilst in the latter only high-grade ones are possible. Whilst in the former it is probable that a certain small proportion of chlorine finds its way into the manure, there is little likelihood of such occurring in the latter. Even if two per cent. of chlorine were present in the Rhodesian mixture, at this rate of application only 4 lbs. would be applied per acre.

This reveals one of the disadvantages attending the use of highly concentrated fertilisers. The concentration of a manure implies the elimination of some "impurity" which may have a beneficial effect on the crop. The general adoption of double superphosphate in place of ordinary superphosphate has thus lost to the farmer a valuable impurity—sulphate of lime.

Other Sources of Chlorine.—

Soil.—Reverting to the consideration of soil chlorine, it may be noted that all agricultural crops take up a certain amount from the soil, and drainage waters always contain more or less chlorine. This element appears to be removed readily by leaching.

The ridges in a tobacco field use up roughly 3 inches of the surface soil, and the weight of this is approximately 1,000,000 lbs. per acre. If the average chlorine content is 0.004 per cent., the total chlorine available for the crop will be 40 lbs. per acre. This is very meagre, in view of the estimate that an average tobacco crop in the U.S.A. absorbs 27 lbs. from 1 acre. The leaching rains of the tropics compete with the tobacco rootlets, and the roots themselves have only a limited feeding range.

A simple calculation shows that 1,500 lbs. of tobacco (leaf, root and stem) with 0.036 per cent. of chlorine (the average of 11 Rhodesian samples) take up 0.54 lbs. (9 ozs.) of chlorine.

Rain.—The analysis of rain water shows that appreciable amounts of chlorine may be deposited in the form of salt. The amounts depend upon the distance from the sea. The writer has no figures for Rhodesian rainfall, but the following figures collected from various sources show the possibilities of rainfall.

Chlorine Deposited by Rain in One Year.

	Lbs. per Acre.
Leeds Suburban Area	22
Rothamsted Exp. Station, Harpenden, England	16
Cirencester	30
Hebrides (minimum value)	168

Use of Chlorides (Muriates) in Tobacco Fertilisers.—In the older literature of tobacco culture, chlorides or muriates (muriate of potash, salt, ammonium chloride) were avoided owing to observations that chlorine had a deleterious effect in reducing the rate of burn of the leaf. African tobacco suffers from too rapid a burn, probably in consequence of its meagre chlorine content.

More recently it has been found that chlorine may have beneficial effects when used in appropriate amounts. Thus Hornby(1) wrote:—

> "The characteristic specking due to lack of available potash is sometimes seen on bright tobacco, especially on sandy types (of soil), when late planting leads to ripening in dry months. A characteristic drought spotting . . . is also seen at such periods. The chloride or muriate of potash has a greater effect in preventing such spotting than the sulphate. In general, small (e.g., 30 lbs. per acre) applications of the chloride are preferred for dark tobacco and of the double manure salts for bright tobacco, the latter being used as we have stated in side applications. The decreases in rate of burn due to these applications is nearly always of advantage to leaf grown under the average weather conditions of Nyasaland."

Again, Hornby(2) recommended for Burley tobacco applications of 70 lbs. of a mixture of muriate and sulphate of potash:—

> "The source of potash should be half from the muriate, which on some soils helps in preventing sand drown." (A magnesia deficiency disease.)

In April, 1930, a comprehensive account of certain chlorine manuring experiments in the U.S.A. appeared in

the *Journal of Agricultural Research* by Garner, McMurtrey, jnr., Bowling and Moss(3). These writers conclude:—

> "As judged by expert buyers on the basis of appearance, leaf tobacco grown with a limited supply of chlorine has shown a moderate increase in market value. Under the conditions of the tests, maximum effects in this direction have been obtained with 20 to 30 lbs. of chlorine per acre. It is possible that under some conditions somewhat larger quantities would be required for best results. With an excess of chlorine in the fertiliser, the market value of the leaf has been materially lowered."

A conference of experts from the tobacco States of the U.S.A.(4) drew up in 1929 certain manuring formulæ and recommended the inclusion of muriate of potash to give a maximum of 2 per cent. chlorine. They gave warning that if larger amounts were used there would be danger of bad colours in the leaf. The formulæ for bright tobacco mixtures varied according to the type of soil—namely, 8: 3: 5, 8 : 3 : 3, 8: 4: 6—and the rates of application were from 800 to 1,200 lbs. per acre. The amounts of chlorine would thus be from 16 to 24 lbs. per acre.

The conference held in 1931(5) further added that in the manure for plant beds not more than 1 per cent. chlorine should occur in the mixture.

Experiments in Nyasaland.—Our experiments commenced in 1928, when the source of the chlorine was still obscure. It was not known whether the plant would take it up readily, nor whether one form of chloride was preferable to another. It was decided to experiment with three types of soil and with three common chlorides, viz.:—

Common Salt ... ... containing chlorine 54 per cent.
Muriate of Potash ... ... containing chlorine 46 per cent.
Magnesium Chloride ... ... containing chlorine 70 per cent.

The first tests were carried out in the greenhouse on the variety Gold Leaf.

Greenhouse Trial.—The soil types and treatments are briefly described.

Chilwa Sand.—A very coarse sand which was taken from the shores of a brackish lake. Its agricultural value is negligible.

Estate Soil.—A very fine sand of light colour and close texture. Virgin soil.

Black Soil.—A rich black loam taken from the banks of a stream. A typical nursery soil.

The chemical analyses of these showed:—

	Sand.	Estate Soil.	Black Soil.
	%	%	%
Nitrogen	0.008	0.106	0.195
Organic matter	...	3.78	9.72
Available phosphoric acid	...	0.130	0.040
Available potash	...	0.016	0.054

Every plant received 1 oz. of a complete fertiliser analysing 36: 14: 14. The additional manures given were:—

Sand.—

Control: 2 ozs. limestone, ¼ oz. magnesia.
Salt: the same, with 2 ozs. common salt.

Estate Soil.—

Control: nil.
Salt: 2 ozs. common salt.

Black Soil.—

Control: nil.
Salt: 2 ozs. common salt.
Magnesium Chloride: 1½ ozs.
Potassium chloride: 2¼ ozs.

The leaf was harvested, air-cured and analysed with the following result:—

Chlorine Percentage of Ash (Free of Sand and Carbon).

Treatment.	Chilwa Sand.	Estate Soil.	Black Soil.
	%	%	%
Control	5.5	15.3	8.9
Salt	15.4	20.3	14.0
Magnesium chloride ...	...	...	18.0
Potassium chloride	...	...	18.2

Field Trials.—In 1928-30 the test was repeated under estate conditions. All the plots received the same general manure mixture. The special treatment of the chlorine

plots is summarised below. The leaf was harvested, cured and analysed, and the chlorine found in the ash is shown in the table. The variety was again Gold Leaf.

	Special Treatment. Lbs.	Chlorine % of Ash. Grade C. %	Grade SB. %
Season 1928-29—			
Control	Nil.	0.4	1.7
Salt	50	0.9	2.4
Mag. chloride	50	0.7	2.6
Pot. chloride	50	0.7	2.8
Salt	90	2.5	6.5

Rainfall: December-February, 25.17 ins.; March, 9.07 ins.

Season 1929-30—			
Control	Nil.	4.5	6.4
Salt	50	7.7	9.7
Pot. chloride	50	8.0	...

Rainfall: December-February, 15.10 ins.; March, 6.04 ins.

In the same season a test was carried out on another estate. Three plots received identical amounts of phosphoric acid, nitrogen and potash—viz., 26, 14.5, 36 lbs. per acre. The chlorine supplied in the manure and subsequently found in the ash was as follows:—

Chlorine Supplied per Acre.	Chlorine % of Ash.
Nil.	4.0%
25 lbs.	5.9%
42 lbs.	6.5%

Rainfall: December-February, 18.22 ins.; March, 7.73 ins.

Discussion of Results.—It was concluded from the greenhouse test that the introduction of chlorine into the leaf would be a very simple matter. The plants took up chlorine from the manured soils with avidity, and the amounts found in the ash of the leaf were of the same order as was found in American leaf.

It was curious, however, that even the controls which had not received chlorine with the fertiliser showed a higher chlorine content than had hitherto been found in African tobacco.

The subsequent field tests showed that chlorine never reached such high values as in the greenhouse test. The

difference is no doubt due to rainfall. In the greenhouse the plants received the necessary amount of water, and this was applied to the soil. The leaves themselves were sprayed only two or three times during growth. On the other hand, the tobacco grown in the field was subjected to considerable rain, which would cause the chlorine to be leached out of the soil and might even cause a loss of chlorine from the leaves themselves.

In support of this view we have the fact that in season 1928-29, when the rainfall was high, the tobacco showed a much smaller intake of chlorine than in season 1929-30, when the rainfall was low.

The average rainfall (57 years) for the three months June to August at the tobacco sub-station at Windsor, Connecticut, U.S.A., was 11.84 inches, and if we take this as typical of the U.S.A. we shall understand why it is difficult to increase the chlorine content of tobacco grown under conditions of high rainfall. Providing that the tobacco is grown in a dry area or during the drier months, there seems little doubt that it will be possible to adjust the chlorine content of African tobacco to that of American growths. Under wet conditions, however, it would appear to be difficult to achieve this result. Late dressings of muriate would probably be most effective.

The effect of wet and dry seasons on the chlorine content of tobacco was remarked on by Bailey and Anderson (6), and the following quotations are taken from their report:—

> "The poor burning crop of 1924 was grown in an extremely dry season, and the good burning crop of 1927 during a season of high rainfall."
>
> "*Chlorine.*—In the dry year crop of 1924, the chlorine content of the leaves was from two to ten times as great as in the 1927 crop. Perhaps no one element is more deleterious to burn than chlorine. It is therefore probable that this was a second contributing factor to the poor burn of the 1924 crop. Since chlorine salts are very readily leached from the soil, it is to be expected that during the wet year any chlorine which was in the fertiliser would be quickly carried away, while during the dry year the chlorine salts would be absorbed by the roots of the plants."

Effect of Chlorine.—Chlorine is not necessary to plants in large quantities. It has been observed with certain crops that when it is applied in non-toxic quantities the transpiration of water from the leaves is reduced. Chlorides thus have a beneficial effect in dry seasons in preventing crops from drying out. As regards tobacco, a higher chlorine content would facilitate handling of the leaf during the dry weather and reduce breakage, as the cured leaf retains rather more moisture when chlorides have been applied(3).

In our field experiments, the growing plants had an excellent appearance in the field, and no difficulty was experienced with the curing even when 50 lbs. of chlorine were applied per acre. The colour of the cured leaf was suitable for the semi-bright grade which was aimed at in this case, but it is uncertain whether satisfactory bright grades could have been produced. The yield per acre of saleable leaf was higher from the chlorine plots than from the non-chlorine.

The conference of tobacco experts (U.S.A.) declared in 1929 that large amounts of chlorine reduce the quality and produce thick, brittle leaf which cures dull. There is much less risk of such injury with African tobacco, in view of our higher rainfall and the ease with which chlorine is leached away.

Conclusion.—In the writer's opinion, it is desirable that the chlorine content of African tobacco should be increased with a view to slowing down the rate of burn and of bringing the composition of the leaf nearer to that of American leaf. Attention has been drawn to certain benefits. The danger attending large applications is considered to be small under our conditions. At this stage it is not possible to say to what extent the other constituents of the leaf are affected.

Field trials will need to be carried on over a period of years in order to ascertain what quantities of chlorine in the form of salt or muriate of potash should be applied, but in the meantime it is considered that no risk whatever will attend the application of 25 lbs. of chlorine per acre. This amount would be carried by 47 lbs. of common salt or 54 lbs. of muriate of potash. Larger applications than this cannot be advised until further experience with chlorine has been gained.

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(3) Garner, W. W., McMurtrey (jnr.), J. E., Bowling, J. D, and Moss, E. G.—"Role of Chlorine in Nutrition and Growth of the Tobacco Plant and its Effect on the Quality of the Cured Leaf." *Jour. Agric. Res.*, Vol 40, No. 7. April, 1930.

(4) *Tobacco.* 19th September, 1929.

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SOME EVERYDAY PROBLEMS OF THE RANCHER.

By A. E. Romyn, Senior Animal Husbandry Officer.

1. A Breeding Policy.—In Southern Rhodesia we have not yet arrived at a satisfactory cattle breeding policy, and for this the local market is largely to blame. It has shown comparatively little discrimination in favour of quality, and, in the absence of an export market for the better class of cattle, there has been very little encouragement to improve the ordinary run of herds. In fact as a result the quality of the beef cattle in Southern Rhodesia has gone back, rather than advanced, during the last decade, and the general idea has gained credence that the man who has made the most out of cattle farming is the man who has taken the least trouble with them.

The experimental shipments of chilled beef to Smithfield which have taken place recently have already brought about some change in this pessimistic outlook and if the trade goes on as it promises, there will soon be a demand for better bulls with which to breed up to the "export standard."

One of the chief obstacles to be overcome in the course of improvement is the difficulty met with in acclimatising imported animals. European breeds of cattle have not yet adapted themselves to what are here considered normal ranching conditions. They are said to be "out of harmony" with the environment and, to overcome this disability, either the environment must be altered to suit the cattle or cattle must be bred to suit the environment. Generally the more practicable course is to modify the cattle.

With this in view a common practice in the past has been to start with cows of native type and grade these up with bulls of an imported beef breed. Where it is necessary to secure more size and uniformity in the foundation herd,

the cows are usually bred to an Africander bull and the progeny then crossed with bulls of an imported breed. Sooner or later, however, the products of both these systems of breeding show, under ranching conditions, a lack of hardiness. In most cases the most satisfactory way of recovering this hardiness has been to re-introduce the Africander for one or two generations.

This policy of reverting to the Africander has something to commend it. The procedure is simple and so far has been comparatively successful. The chief practical difficulty has been a shortage of suitable Africander bulls. With local modifications a similar policy of crossing back to an "indigenous type" is now being tried in most of the tropic or semi-tropic cattle-raising countries. It is a method of breeding that calls for much less skilful management than the selection of a single definite type to suit special conditions. For this reason it has become common practice in South Africa and serves as a temporary policy until the industry has had time to feel its way before settling down to a more definite line of action.

It is generally felt that the policy is a stop-gap one and will presently have to be replaced by a systematic endeavour to breed a type suited to local conditions from either an imported breed, an indigenous type, or a cross between the two. In the meanwhile it enables the rancher to carry on.

The policy is not, however, without objections. It is often used as a cloak for shiftless cattle farming, and, in many cases, a great deal of the deterioration which takes place in imported breeds under ranching conditions is due to lack of proper culling in the breeding herd. By the use of suitable bulls and the rigid selection of the females, continued progress can be maintained under seemingly unfavourable conditions without any radical alteration in the environment.

We have not had much experience in the export of chilled meat, but apparently the Africander cross, if properly finished, is quite acceptable on the English market. The question of age and finish do, however, introduce complications where this cross is concerned. At an inter-State conference held recently in Pretoria it was agreed that, after the present year, cattle over five years of age would not be passed

as "chillers" for export. It was held further that it would probably be necessary later on to reduce this age to four years.

Ranch cattle, under our conditions, do not usually take on a satisfactory finish until they are five years old, and, if this age is reduced to four years, it is likely that the bulk of the ranch cattle exported will have to be fed grain for a limited time before marketing. This would place the Africander at a disadvantage as it is slower in maturing and not as good a stall feeder as the imported beef breeds of cattle, and, though modification of certain characteristics of the Africander breed is proceeding apace it will probably be advisable for many years to come to maintain an admixture of more than half European blood in steers intended for export.

The breeder should aim to keep a balance between the environment and the type of cattle he produces. He should improve this environment to the limit justified by the probable economic returns and then breed the earliest maturing and most improved beast the environment is capable of supporting. In favoured areas this policy will permit of the development of the more or less conventional European beef type. In most cases, however, it will require some admixture of Africander blood in the market steer and the more unfavourable the conditions the nearer the native type it will be necessary to keep.

During the present depressed state of the cattle market many ranchers have reverted to the use of grade bulls. The hardiness and cheapness of these bulls has encouraged their use. In some cases the breeding results have been satisfactory but in most cases a lack of uniformity in the herd has followed, and, as a general policy, the practice is one that cannot be recommended.

2. The Replacement of Bulls.—"Bull replacements" is one of the most serious items of expense on the ranch. To escape the heavy annual outlay for new bulls some ranchers breed their own. It is doubtful if the policy has proved a success. It is generally cheaper to buy purebred bulls than to breed them under ranch conditions, and, while grade

bulls can be raised comparatively cheaply they do not maintain the quality of the herds in which they are used. A better policy, where feed and the means are available, is to purchase young bulls to the limit of the feed and equipment available in time to grow them out and to acclimatise them to the local conditions. These young bulls should be inoculated for Redwater and Anoplasmosis before shipment, or should come from farms definitely known to be infected with these diseases. There are ranches in the low veld capable of growing limited areas of feed under irrigation. On propositions of this kind there is scope for an experienced breeder to produce good general purpose acclimatised bulls for sale in the ranching areas.

3. The Breeding Season.—There is some question as to the best breeding season.

The largest percentage of calves is generally obtained when the bulls are run all the year with the cows. Under this method of management the bulk of the calves are usually dropped about November-December, which is a suitable time of the year. The system is, however, very hard on the bulls, and, where proper provision is not made for feeding, the constant work greatly decreases their usefulness. They should, therefore, be taken out and fed up whenever they drop in condition and an arrangememt made to use them in proper rotation, feeding and resting those which are not with the herd.

From many standpoints, however, it is preferable to have a definite breeding season because a more uniform calf crop is secured and the calves are dropped at the time of the year which is best for the growth of the young stock. This period may frequently be in the winter, not the summer months, if winter feed conditions are good or supplementary feed can be provided on an economic scale.

In Matabeleland a common practice under ranching conditions is to run the bulls with the cows from March to September.

In Mashonaland, where early grazing, mostly in the vleis, is usually available, the general practice is to breed the cows from January to June, and, in some cases a shorter

breeding period of from January to April is made use of, and the bulls are put in again for a period in June to July.

The state of the veld when the calf is weaned is in many ways more important than the time of birth, and cows bred as above should drop their calves so that when they are weaned, at 8 or 10 months of age, the veld should normally be in good condition.

In all cases calving before the rains should be avoided as far as possible on account of difficulties in parturition which are commonly met with on dry veld at this time, especially when the cows are in low condition.

4. Veld Management: Fencing and Water.—Good veld management is as important as a sound breeding policy. In many cases it is more important.

There is an old saying that "the nearer the ground the better the grass," and at our stage of development good veld management generally entails paddocking the farm into small enough areas to keep the grass reasonably short by grazing. Several conditions must, however, be borne in mind when laying out these camps. The veld must not be overstocked. This is especially true in the drier areas of Matabeleland and in places where a shortage of water may result in gross over-grazing near the watering places. Provision should be made so that definite areas or camps can be rested in rotation, the grass being allowed to seed and the seedlings given a chance to establish themselves.

Adequate provision must be made for winter grazing. It is poor practice to graze certain paddocks very closely in the growing season and then turn the cattle out on to coarse rank open veld for the winter. There are various ways of arranging this winter grazing. In the "sweet veld" areas the problem is relatively simple. Sections of the veld known to be good winter grazing can usually be reserved for winter feed. The black "turf type of vlei," both in the sour veld and sweet veld areas, is a good natural winter feed if the grass is kept short and properly managed. Vleis of this type, when fenced and well controlled, are of great value for winter grazing. In the "sour veld areas" proper, the problem is more difficult. Winter grazing here is usually so poor that

High grade beef cows on black turf vlei pasture in Mashonaland.

A bunch of yearling grade Herefords on winter veld

Grade Angus steers—mostly second cross—5 to 6 years old.

supplementary feeding on a comparatively large scale is necessary to maintain the growth of cattle and it may indeed be doubted if ranching on a large scale is an economic proposition under such conditions. On a small scale, however, it is often practicable to provide fair winter grazing by fencing one or more camps and grazing these closely in the earlier part of the rainy season. If the cattle are removed before the end of the rains, the aftermath will grow to a fair height, and provide comparatively good grazing during the winter months. Grass burning is still generally resorted to to provide feed before the early rains. The ordinary type of sandveld vlei, if burnt in the dormant season, will provide valuable grazing towards the end of the winter in a normal season. There is, however, the danger that if these vleis are grazed too early and the rains are late there will be a gap between the end of the vlei grazing and the beginning of the normal grass when the cattle will not go back to the dry veld and there may be serious losses from poverty.

Supplementary feeding, except on a limited scale for bulls or poor stock, is seldom practicable on an ordinary ranch. Veld hay, properly made, is probably the most useful supplementary feed under ranch conditions. Where the cutting of a sufficient quantity is not practicable, cowpea hay has been tried with success, and where irrigation water free from brak is available, it is an excellent plan to establish an area of lucerne. Kaffir corn or sunflower silage are other good winter feeds under dry land conditions.

Too much emphasis can hardly be placed on the matter of water supplies. Good water and sparse grazing will often give much better results than plentiful grazing with poor water supplies. Improved cattle should not have to walk more than three miles to water, and the more evenly the water supplies are distributed the better the grazing can be utilised. There are to-day millions of areas of ranching land in the Colony which are only accessible for a brief period during the rains and are never properly utilised on account of a shortage of water. Under these conditions a good plan is to build open earth dams to conserve the run-off and provide water for stock on these "back blocks" during the rains and to reserve the river and borehole grazing for the dry season.

The practice of watering stock at earthern dams, is, however, dangerous in areas where worm infection is prevalent. In these areas the dams should be fenced off and the water piped off wherever possible into a reservoir or tank, or direct into troughs for the cattle to drink.

Apart from the aspect of veld management, fencing has the great advantage that it allows the cattle to run undisturbed throughout the 24 hours.

5. Dairy Ranching.—Dairy ranching has spread of recent years and its expansion is likely to continue until times improve. Under ranching conditions in this Colony it is, however, not possible for a cow that is milked to produce a good calf unless supplementary feeding is provided. This is generally impracticable and a great deal of cream is being produced to-day in areas capable only of maintaining a moderate quality of beef animal. If the export of chilled beef expands it is likely that many dairy ranchers will turn back to beef, but in the meanwhile there is the danger that the pendulum may swing too far from the beef side. Some herds are already so damaged by overmilking that it will take many years to get back into them the size and frame needed for the production of good steers. In fact, where the rancher is in a position not to milk his cows, he will, in the long run, be a wise man to "stick to straight beef."

VELD HAY AND GRASS SILAGE.

No apology is necessary for again referring in this issue to the possibilities which still exist, even at this season of the year, of converting surplus grass into hay or silage. Many paddocks which have been grazed until late December or early January or from which an early cut of grass has been taken, will again be in full growth and the herbage in a fit condition for conversion into either hay or silage. The possibility of severe locust invasion later in the year or during next spring makes it particularly urgent that stock owners should lay in ample reserves of fodder for winter use or in case of emergency.

In well-drained pits, silage will keep in excellent condition for two or more years and the same is true of hay stacks, the sides of which have been well raked and the tops thatched.

The few occasions on which any attempt may be observed to protect hay stacks, left over from one season to another, from the damaging effects of the rainy season well exemplify the waste of food stuffs which is allowed to occur in this Colony. A generous and usually reliable rainfall assures the stock owner that the next season will provide as lavish a growth of grass as each subsequent one, and for the most part he entirely fails to remember that the feed value of the natural veld will have fallen by late autumn to an almost negligible quantity. A more generous provision of veld hay cut at the right stage of growth, and of grass silage conserved in pits, as described in our last issue, will exert an immense influence for good on the cattle industry.

THE LOCUST CAMPAIGN.

By R. W. JACK, Chief Entomologist.

The following is more in the nature of an informal talk concerning the present position than an article on the subject of locust destruction. It deals with the position up to the 15th February.

The Migratory Locust (*Locusta migratorioides*) invasion of the north-eastern districts of the Colony slightly preceded the Red Locust (*Nomadacris septemfasciata*) invasion elsewhere, and the shorter hatching period of the eggs (about 15 days) resulted in the hoppers of this species appearing well in advance of the Red Locust hoppers. The districts chiefly affected are Darwin, Mazoe and Mrewa, and possibly Mtoko. Hatchings of this species commenced on 15th December in the Zambesi Valley and are being successfully dealt with in most localities, including the Zambesi valley towards the Portuguese border in the Darwin district.

The Red Locust invasion has been much more widespread and has extended to most of the districts of the Colony. The first hatchings were reported on January 15 in the Shangani Native Reserve, but since that date extensive hatchings have occurred, including the following districts, namely, Lomagundi, Mazoe, Salisbury, Hartley, Sebungwe, Gwelo, Bubi, Bulalima-Mangwe, Nyamandhlovu, Wankie, Belingwe, Chibi, Ndanga, Insiza, Selukwe, Melsetter, Inyanga, Mtoko, Charter, Mrewa and Marandellas.

The incubation period of the Red Locust has proved to vary considerably. The usual period for this species is recorded as about thirty (30) days. During the present invasion certain deposits have, in fact, hatched in exactly thirty (30) days. No deposits have yielded hoppers in less than that period, but in various instances the period has been considerably prolonged. The longest period recorded occurred

on a sand veld farm in the Salisbury district, namely, about forty-seven (47) days from the date of egg-laying to the appearance of the first hoppers.

Hatching, in the case of this species, has proved to be a somewhat irregular process. It is not quite clear whether this is mainly due to irregular egg-laying by individual locusts in the same locality, or to irregular development of the eggs in the same batch, but it has been observed that all the eggs do not necessarily hatch simultaneously even in the same "pod." In any case hatching of hoppers from a marked egg deposit has frequently continued over a week or even considerably more, leading to difficulties in connection with spraying operations.

The appearance of hoppers of the Red Locust has in most districts greatly exceeded expectations based upon the observed egg deposits and the movements of the flying swarms.

It has obviously not been necessary for a dense swarm to spend a great amount of time in a given locality for extensive egg-laying to take place. The travelling swarms have apparently regularly left large numbers of egg-laying individuals behind, and these, behaving much like ordinary grasshoppers, have in many instances not attracted attention. The passing on of the main swarm has presumably diverted attention from the numerous stragglers left behind. Certain of these stragglers have been dissected and found to be in egg-laying condition. In many instances, on the other hand, the egg-laying activities of the stragglers have been detected and reported.

The heavy hatchings which have occurred have proved a disappointment to those who had hoped that the prolonged wet spell during the time the eggs were in the ground would bring about general destruction and decay. In certain instances a considerable amount of decay was definitely reported, but such field investigation as it was possible to carry out at the time, indicated that in these cases the decayed eggs had actually been destroyed by parasites and enemies and not by the wetness of the soil.

In actual fact it is difficult to understand why wet weather should be expected to be seriously inimical to the

eggs of this species. The Red Locust normally lays its eggs during the wet season and is known to mature successfully in tropical countries having a heavy summer rainfall.

It is true that the meagre available reports referring to the mixed invasions of Southern Rhodesia by the Red Locust and the Brown Locust (*Locusta pardalina*) from 1906 to 1909 indicate that from 1907 onwards, hoppers of the Red Locust did not appear in great numbers, although the Brown Locust hoppers were very abundant up to 1907. It is to be realised, however, that although flying swarms of the Red Locust were prevalent over a large portion of the Colony in 1906 and continued to be prevalent up to the year 1909, information concerning egg-laying was very imperfect at this time due to some extent to the sparse population of the Colony and the lack of legislation in reference to locust destruction, but probably more to the lack of a really effective locust organisation. Egg-laying by the Red Locust within the borders of the Colony may not have been very extensive at this time.

Moreover, the reports refer to years following a period of abundance of locusts in the Colony. Egg-destroying agencies in the form of parasites and enemies tend to increase as a locust swarm cycle proceeds, and may exercise a considerable influence in bringing such a cycle to an end. It is not to be anticipated that during the first year of an invasion these agencies will be sufficiently numerous seriously to affect the hatchings.

It is of interest, however, that egg parasites and enemies have been to an appreciable extent in evidence during the present season and will no doubt increase in numbers and destructiveness if the swarm cycle continues in the Colony.

Destruction of the hoppers has presented considerable difficulties which were not apparent in the case of the Brown Locust invasion in 1924.

In the first place the Brown Locust invaded the Colony during the dry season and laid its eggs from July to September. These eggs lay dormant in the dry soil until about a fortnight after the first soaking rains, when they hatched irrespective of the time at which they were laid. The hoppers which escaped destruction during the subsequent campaign practically all matured by Christmas, and the fliers then left

the Colony. The campaign was therefore waged during a period when the grass was growing but had not yet attained full height, and this, combined with the more-or-less uniform time of hatching greatly facilitated operations.

The time of hatching of both the Migratory and Red Locust has been determined mainly by the time of laying, although climate and soil conditions seem to have exercised some influence. As the period of egg-laying has covered a number of weeks hatching is likely to continue for a considerable period. Moreover, as already mentioned, hatchings from single deposits have been prolonged over a number of days, extending in some cases to weeks.

Where destruction has been attempted within a day or two of the appearance of the first hoppers, the operation has frequently had to be repeated several times over the same ground to destroy later hatched hoppers.

The continuous wet weather experienced in January has also been a serious handicap.

Furthermore, the very young hoppers do not seem to unite into considerable swarms until some time after hatching. Reports are to the effect that they unite more as they grow older, but the actual time which elapses before this takes place is at present uncertain. The very young hoppers are to be found in small loose clumps scattered widely over the veld, and this does not facilitate their destruction.

The advice at present is to allow about ten days to elapse before attempting spraying, providing that this can be done without risking invasion of crops, and also to be guided by experience. It is hoped that more detailed instructions will be possible in future, but at the present time there is not sufficient information available.

It is a remarkable fact that notwithstanding the trouble experienced in South Africa with the Red Locust about a quarter of a century ago, very little has been placed on record concerning its habits and life history.

The period occupied by this species in developing from hatching to the winged stage is stated to approximate two (2) months.

It is also generally thought that this species in South Africa passes through only one generation during the year, and this is probably correct.

The course of events as far as Southern Rhodesia is concerned would appear to be as follows: What may be termed the great breeding migrations of the swarms appear to occur early in the wet season, and at this time the flying swarms tend to invade new country, flying more-or-less in one direction. As soon as the swarms begin to attain egg-laying condition migration in a specific direction ceases, the swarms commence to circle and afterwards move irregularly as egg-laying proceeds.

The migratory flights in the present invasion were comparatively rapid and very little damage was reported, but the circling swarms fed greedily and crops suffered considerably in some areas.

After the hatching of the eggs, the hoppers grow up during the wet season, and, of course, feed freely, and are capable of a great amount of damage.

Hoppers of the present outbreak are likely to continue to mature up to April or May.

From the time the locust obtains wings until the time breeding occurs there is apparently a very long period which is known as a diapause. This period will presumably extend from April or earlier until December.

The flying locusts during this period lead an aimless kind of existence, but keep together, at least to some extent, in swarm formation. This is a point which calls for further observation. According to available reports they feed freely on favoured crops for some time after obtaining wings, but their feeding and other habits during the height of the dry season appear to be insufficiently recorded. They obviously constitute a potential danger to winter crops.

The flights during the winter appear to be irregular, although there may be an indication of a general drift in a definite direction. Whilst considerable distances are covered in such movements, these do not, apparently, compare with the mass migrations of the early part of the rainy season.

It is a matter of interest that until recent years the Red Locust was regarded as an East African species. This was due to the fact that experience south of the Zambesi River pointed to the low veld of Portuguese Territory and Natal as the main breeding ground, and the plateau as an area subject to regular invasions from that direction. Recent experience, however, suggests that Mocambique and Natal are not permanent breeding grounds of this species but that these breeding grounds are to be sought somewhere further north and further west. Their exact location is unknown at the present time, but the present swarm cycle certainly developed to the north of Southern Rhodesia.

The expression "permanent breeding grounds" calls for some explanation.

The name "locust" is generally applied to certain insects, having the general appearance of grasshoppers, which move about in swarms. Actually locusts may be more correctly described as grasshoppers, which in certain circumstances exhibit a swarming and migrating habit.

It has been shown in the case of the Brown Locust in South Africa and some other species elsewhere that locusts are not always met with in swarms. In their permanent breeding grounds they live as solitary grasshoppers. This is the "solitary phase." The appearance of locusts in their solitary phase differs to a considerable extent from their appearance in the "swarm phase," so much so that the two phases have in certain instances been described as distinct species. Locusts in the solitary phase increase in numbers under favourable conditions and become gregarious. As the cycle of increase progresses the permanent breeding grounds send out great swarms of flying locusts which migrate for hundreds of miles. These migrating swarms produce new generations in the country overrun, but this country is not suitable for the production of an indefinite number of generations, and whilst the locust population may be renewed by fresh invading swarms over a period of several years, the swarm cycle inevitably passes, the invaded country becomes free again and the locusts are once more confined to their permanent home.

Southern Rhodesia does not as far as is known afford a permanent home to any of the three species of locusts recorded in the Colony. This is understandable in the case of the Brown Locust, which finds its permanent home in the dry Karroo regions of the Union of South Africa, and apparently cannot long endure the humidity of the Rhodesian wet season. The reason is, however, uncertain in the case of the Red and Migratory species. The Migratory Locust which has invaded the Colony is really the tropical form of the Migratory Locust of Europe and Southern Asia. The tropical form seems to favour very hot and humid climates and possibly Southern Rhodesia is neither sufficiently hot nor sufficiently humid, or at least not sufficiently both hot and humid, for this species. The Red Locust is a purely African species and it seems probable that Southern Rhodesia comes very near to affording suitable conditions for permanent habitation by this species, in fact, it cannot be stated definitely that the species does not breed permanently in some parts of the country. Specimens of the solitary phase were taken in the Colony some years after the last swarms of the previous swarm cycle of the Red Locust had disappeared, namely, in 1915. It is, however, clear that the Red Locust did not breed up to the swarm phase within the Colony in connection with the present outbreak. The invading swarms definitely came in from the north.

It may be mentioned that certain species of locusts are known in the solitary phase in certain countries in which they never occur in the swarm phase.

The trend of the swarm movements of the Red Locust which has produced the present invasion of this Colony, obviously threatens the eastern seaboard of South Africa and the prospect appears to be that the position recorded a quarter of a century or more ago is likely to be reproduced, probably from next year, namely, that a swarm cycle extending over several years will extend to Mocambique and Natal, affecting also the northern and eastern Transvaal as well as Southern Rhodesia.

The prospect in connection with the Migratory Locust is quite uncertain. This species has not been recorded previously as breeding in Southern Rhodesia, but it may well

have been confused with other species, especially the Brown Locust. It is apparently breeding very freely in the Zambesi Valley both in Southern Rhodesia and in Portuguese Territory; also in Nyasaland. It has persisted in Northern Rhodesia in common with various States further north for some years past. In fact its present swarm cycle apparently includes a great belt of central Africa from the Atlantic to the Indian Ocean. The southernmost record for this species was established early last year when large swarms invaded the Union of South Africa from Bechuanaland, and holding a general south-easterly direction finally reached the neighbourhood of the Drakensberg Range, but failed to cross. The invasion was altogether abortive and the swarms failed to breed.

Whether continued invasion of Southern Rhodesia by the Migratory species is to be anticipated or not is quite uncertain.

The Campaign.—The decision as to the scope of the campaign to be waged against the offspring of the invading swarm has been beset with difficulties.

In the first place neighbouring territories are not in a position to wage a really exterminative campaign against locust hoppers. As far as is known nothing at all is to be attempted in Ngamiland, whilst in Northern Rhodesia little beyond defence of crops is being attempted. Our Portuguese neighbours are doing what is possible, but the country is large with a small European population, and operations are exceedingly difficult.

One of the unfavourable features of the present invasion is the extensive breeding which has taken place in the Zambesi Valley and other remote places, which are almost inaccessible in the wet season.

In the circumstances it appears that however intensive a campaign might be waged in Southern Rhodesia, it would have comparatively little effect on the prevalence of winged swarms later, as these are practically certain to mature in large numbers in neighbouring territories to invade this Colony in due course.

In the circumstances the economy of attempting extermination in the remoter localities is very questionable, the most obvious course being to confine efforts to the protection of crops.

There are, however, other considerations which render such a decision inadvisable.

In the first place native crops in some of the remoter areas are threatened by the hoppers, and are in fact reported to have suffered severely in certain localities. It is necessary to do what is possible to assist the natives in defending their food supply.

Secondly, swarms of fliers maturing on vacant land at no great distance from the settled areas constitute a more-or-less immediate threat during the dry season, whereas the prospect of extensive invasion from a distance during this period is less definite. It is very uncertain what the flying swarms will do during the dry season, but there is a possibility that mass invasion may be postponed until the spring.

Consequently a balance has been struck between the impossible undertaking of complete extermination everywhere and a policy which would admit of large swarms of fliers maturing unchecked throughout the Colony.

In other words, destruction is being attempted wherever this is at all possible, and the settled districts are receiving particular attention with a view to effecting something approaching a complete clean-up in these areas.

Technique of Destruction.—It is hoped that the present campaign will add considerably to our knowledge of the best methods to utilise for the destruction of Red Locust hoppers.

Spraying.—At present reliance is being placed on spraying, which proved eminently successful during the Brown Locust campaign in 1924.

This method has its drawbacks and limitations, but so far nothing better suited to conditions in this Colony has appeared. Advice from elsewhere based on recent experience is to the effect that where water is available spraying is much the most feasible method to use against the Red Locust in the wet season in country where the grass is normally long and moderately thick.

In the case of spraying, arsenite of soda solution is used largely as a contact insecticide and effective operations depend upon the hoppers congregating together in reasonably dense clumps. The most effective work is generally done in the morning and evening when the hoppers are resting. In the heat of the day they are normally very active and the formation of the swarm is much looser.

The length of the grass is generally a hindrance to the work of destruction, but it gives certain advantages, as, for instance, in checking rapid movements of the swarms. Another advantage appears to lie in the fact that if the grass is sprayed immediately in front of a moving swarm, the hoppers get wetted in passing through the sprayed strip and perish. No doubt also they tend to drink the liquid in these circumstances. It is difficult to observe exactly what happens, but the result is satisfactory. A five to ten yard strip may be used. If the swarm is very long a second strip may be sprayed further back, cutting through the swarm.

On the same principle a swarm may be driven together and the grass sprayed around it, or the grass sprayed around a resting swarm in the early morning before movement commences. The efficacy of these methods appears to depend on the grass remaining wet when the swarm moves into it.

In general there is a very natural tendency for natives to apply the poison much too heavily, and they need constant checking in this connection. A very light spray is all that is required. The tendency is to drench the hoppers and to go on drenching them, which is both wasteful and dangerous should any stock stray on to the sprayed area. If the work is carried out correctly and proper precautions are observed, there is very little if any danger to stock.

Dusting.—In the Union of South Africa the use of arsenite of soda powder as a dust has largely displaced spraying against the Brown Locust. This method has very considerable advantages in that it does away with the necessity for pumps or other distributing apparatus, and also, of course, for water. The powder is put up in 5-lb. tins and the method of procedure is to make five small holes in one end of a tin and to shake the powder lightly over the swarm to be destroyed. Certain precautions are necessary and use of the

method is practically confined to trained operators. In the hands of untrained or careless operators considerable danger of poisoning stock is involved and the operator himself may suffer severe burning if he is not careful always to work from upwind, to keep out of the way of the floating powder and to take other obvious precautions.

Conditions in reference to control of the Brown Locust in the Union are very different from conditions pertaining to the control of the Red Locust in this Colony. The Karroo and adjacent areas are in general either covered with short, sparse Karroo bush or scanty grass, and the climate is semi-arid. In Rhodesia in the wet season the grass is frequently long, especially in fertile areas, and the weather is liable to be very wet.

It is reported that under these conditions the arsenite of soda powder is liable to clog and dusting to become almost an impossibility. Moreover, tests carried out to date indicate that in long grass the effects of dusting are somewhat inferior to those obtained from spraying. This is, however, only the preliminary indication. Dusting gives the best effect when carried out whilst the grass is wet with dew. Further tests are being carried out by the Department.

A number of farmers have tried dusting, but have discontinued the practice as being too dangerous to the native operators. One of the difficulties encountered has been lack of wind to distribute the powder. In still air, which is frequently prevalent in the wet season, it seems very difficult to dust swarms effectively from the tins and to avoid constant contact with the powder. Inexperienced natives under these conditions tend to get covered with the powder and this is liable to have serious results.

Baiting.—A procedure which has been considerably developed in certain countries is *baiting*. A bait is prepared using horse droppings, bran, meal, sawdust or other available material as a base, and arsenite of soda as a poison. Sugar or molasses is sometimes added. This is distributed in front of slowly moving swarms which are feeding on the march, or amongst and around resting swarms. The poison in this case is being definitely used as a stomach poison and not as a contact insecticide.

To date during the present outbreak, no opportunity has occurred of testing baits against the Red Locust, but tests are planned in this connection. The method seems definitely inapplicable to very young hoppers in comparatively long grass and it is questionable to what extent it can be utilized in a locust campaign in this colony. Locusts generally need moisture, and it is possible that a moist bait would attract them in dry weather but not in wet. In any case if the hoppers are on the march through grass the most feasible procedure appears to be to spray the grass in front of the swarms. The economy of utilizing bait seems mainly to depend upon the distance to which water has to be transported for spraying. It has been suggested in Kenya that four (4) miles is about the limit to make baiting more economical than spraying.*

Baiting is employed to a considerable extent against the Brown Locust in the Union of South Africa, horse or mule droppings being largely used as a base. There are of course difficulties associated with water supply for spraying in this region which have undoubtedly had a large influence on development of both dusting and baiting methods.

Contact Insecticides.—The possible limited application of the old method of spraying with soap solution in the case of hoppers hatching out in the middle of crops, as they frequently do, led to certain tests being made. Soap solution up to 2 lbs. in 4 gallons of water failed to injure maize in a series of tests. On the other hand a few tests carried out against hoppers gave the result that even at the greatest strength used, i.e., 2 lbs., in 4 gallons of water failed to kill. Further tests are being carried out.

Flame Throwers.—There is nothing which appeals to the general public more than the idea of using flame throwers, blow lamps, etc., against locust hoppers.

The explanation of this appeal probably lies in the fact that the method is spectacular. Otherwise it has a number of very obvious disadvantages. In the first place it is bound to be enormously expensive in a country where petrol and paraffin cost as much as they do in Southern Rhodesia. The

*Report on the 1931 Locust Invasion of Kenya. Bull. No. 21 of 1931. D/A.

method cannot be used on growing crops without damaging the crops. No government is likely to issue petrol and paraffin free of charge for locust destruction. In arid localities the method has no obvious advantages over spraying because it costs much the same to transport petrol or paraffin as to transport water. Finally, although less spectacular spraying is without doubt more efficient.

Flame throwers have been tried on a large scale in various countries and according to the press have been used of recent years in Palestine, Syria, Iraq and elsewhere. Countries which have had most experience of this method appear to have abandoned it, chiefly owing to the cost and the danger to the operators, several fatal accidents having occurred.*

Even in countries where petrol is cheap the cost is given at over six (6) times that of baiting. Reports from Kenya (*loc. cit.*) are to the effect that spraying is at least as economical as baiting if water is available within 4 miles. It may be reckoned roughly, taking the high cost of petrol in Southern Rhodesia into consideration, that the use of flame throwers would cost in this colony at least ten (10) times as much as spraying and dusting and probably a good deal more.

The only advantage flame throwers have over the use of poison is that there is no risk of stock poisoning. The risk is in fact confined to the operators and anyone near enough to share it.

* The information on flame throwers has been taken from Uvaros's standard work "Locusts and Grasshoppers," published by the Imperial Bureau of Entomology in 1928.

THE VITAMINS IN POULTRY FEEDING.

By G. H. Cooper, Poultry Officer, Matopo School of Agriculture and Experiment Station.

The vitamins are now ranked equal in importance with proteins, carbohydrates, fats and mineral salts, by both scientific and practical poultry keepers. As yet chemists have been unable to determine the exact composition of the different vitamins, but it has been found possible to distinguish them from each other by observing their effect when animals are fed rations deficient in one or other vitamin. They have been found to be essential for growth, reproduction and maintenance of health and wherever there is a prolonged deficiency in the ration of any of the vitamins, animals usually develop a characteristic deficiency disease or condition.

The writer has found at least one of these deficiency diseases prevalent in Rhodesia at certain times of the year, and it is in the hope that poultry keepers generally will understand it better, that the subject is here dealt with.

Up to the present seven vitamins have been discovered and named by the letters A, B, C, D, E, F and G. With the possible exception of F, all are generally recognised.

The amount of vitamins required by poultry varies with the age and condition of the birds. Chicks, laying hens and moulting birds require larger quantities than others. These vitamins are found in natural foodstuffs in minute quantities and some feeds are entirely lacking in one or several of them; hence it is essential to know that the ration contains sufficient vitamins, otherwise we may expect trouble. We must know what feeds commonly used are rich in vitamins and these feeds must be used.

Vitamin A.—This is the most important vitamin with which we have to deal from a Rhodesian point of view. The

deficiency disease previously referred to is the one frequently met with in this country due to a lack of vitamin A. It is known by various names, such as "Nutritional Roup" or "Deficiency Disease." The correct name is Avitamosis: A.

A serious deficiency of vitamin A frequently causes the eyelids of animals to become granular and sticky; later a film gathers over the eyeball and blindness results. In poultry this condition is usually accompanied by creamy-white pustules in the roof of the mouth and down the oesophagus, together with a secretion from the eyes which sometimes causes swelling of the face, because it cannot escape unless forced out by hand. An excess deposit of urates may be found in the kidneys which may appear nearly white in colour.

The disease may easily be confused with roup, but may be distinguished from it by the fact that it is not infectious and that there is an absence of the formation of false membranes in the mouth and throat. Also the offensive odour associated with roup is absent.

Owing to the fact that vitamin A when fed in excess of requirements can be stored in the body and utilised later by the bird, the absence of it in a ration may not be felt for several months. Accordingly we find various degrees of severity of this disease in single flocks, some only showing lack of vitality and low production whilst others will be dying of the most advanced form of the disease.

Vitamin A is found in practically all green succulent feeds, in well-cured lucerne and other green leaf-meals, in yellow maize—but not in white maize—in skim-milk, yellow carrots, sprouted oats, eggs, tomatoes, spineless cactus, majordas and cod liver oil.

As will be seen from this list it is very easy for the birds upon many Rhodesian farms to lack this essential vitamin during the dry months, especially just prior to the rains, if they are not being fed yellow maize, milk or dry green leaf-meal. During this period if succulent green food of some description cannot be fed it is essential to feed yellow maize and lucerne—or sunflower—leaf-meal, about 10 per cent. of the latter in the mash. For those who desire to play absolutely safe, 1 per cent. of cod liver oil in the mash will

provide an adequate amount of this vitamin, when other sources are not available.

The lack of it is felt more by chickens which are growing during this period because they have not had a previous season in which to store any excess they may have been able to accumulate from free range. When available, give all birds all the green feed they will eat without causing looseness of the bowels, that they may have an opportunity of storing this vitamin within their systems to help them through any later deficiency.

The leaves of many of the wild trees will be eaten by poultry, and if one is absolutely stuck, any green feed of this kind available may be tried provided it is not poisonous, by chopping it and adding it to a wet mash. All the infertile eggs from the incubators may also be fed to the chicks, without cooking, mixed with mash.

No amount of syringing or other treatment will cure this disease, but very quick recovery is effected immediately the vitamin A is supplied, unless the case is too far advanced that so much vitality has been lost that the bird is not worth keeping in any case.

Vitamin B.—A continued deficiency of vitamin B in the ration causes a partial paralysis which becomes complete before death. This disease is known as chicken beri-beri and is only produced in the laboratory when rations notably deficient in vitamin B are fed, because of the wide distribution of this particular vitamin.

Vitamin B is found in large quantities in most of the cereal grains and is never lacking in the usual poultry rations. It is found in maize, oats, wheat, bran, pollard and most likely in *inyouti* and sunflower seed in large quantities. Yeast is exceptionally rich in it.

Vitamin C.—Prevents scurvy. Hens are not subject to scurvy, but small amounts of vitamin C are found in the hen's body, hence some is probably required. It is not necessary to supplement it for poultry. Found chiefly in green feeds, fruits and a little in milk products.

Vitamin D.—Vitamin D is concerned in the use of calcium and phosphorous. Its absence from the ration causes the bones of young stock to fail to harden and a deficiency disease called rickets develops. This is frequently called leg weakness because of lameness and inability to stand. Vitamin D is necessary also for egg production and hatchability. Its presence in the rations helps to form strong-shelled eggs.

Vitamin D is one of the most important of the vitamins for it is difficult to supply it in the feed.

Fortunately the ultra-violet rays of sunlight is an effective substitute for vitamin D, having the same effect upon the metabolism of calcium and prosphorous.

In Rhodesia will all our sunshine the want of vitamin D is never experienced. Points to bear in mind, however, are the ultra-violet rays will not pass through ordinary glass into the brooder-house, hence the use of substitutes such as "celo-glass" which have been manufactured especially to allow these rays to pass through. Should we ever experience a more or less sunless rearing season, which is almost unthinkable, then probably we should have to feed 1 per cent. cod liver oil in the feed, especially to the growing stock, as it is the only feed with any appreciable amount of vitamin D in it, with the exception of eggs and a little in lucerne, green and dry. It is the most important vitamin to be considered in the northern hemisphere. Ultra-violet light may be produced artificially, but to do so is more expensive and troublesome than feeding cod liver oil.

In view of the effect that either vitamin D or ultra-violet light has upon egg production, shell formation and hatchability, apart from growth, it will be seen how necessary it is, from this point of view alone, to allow our layers, breeders and growing chicks access to the sunshine, and what a cheap and pleasant form of substitute for vitamin D we are blessed with in Southern Rhodesia! Vitamin D is stored in the body like vitamin A.

A form of leg-weakness may sometimes appear amongst growing chicks at six weeks old when they are receiving

ample vitamin D or unfiltered sunshine and feeds rich in calcium and phosphorous. This may on occasion be due to overcrowding, bad ventilation, heat wrongly distributed, or other bad brooder practices, etc., but is more often due to overfeeding quickly growing chicks upon starchy feeds, chiefly maize. Therefore wheaten bran should be substituted for some of the maize. Given skim-milk and more green feed if possible, recovery is usually complete. More than 55 per cent. of maize in the total ration of growing chicks will often cause this form of leg-weakness, but it is not concerned with vitamin D.

Vitamin E.—Vitamin E is necessary for successful reproduction. A lack of it in the feed produces sterility and a loss of the mother instinct. Not much is known about its effect upon poultry, but since egg production is reproduction it appears to be important. It is not likely to be lacking in the average ration, as most of the cereals are rich in it, viz., yellow maize, oats, wheat, pollard, bran and lucerne, green and dry.

Vitamin F.—Is not important.

Vitamin G.—This is the most recent addition to the list. It is essential for rapid growth in chicks and probably necessary for good hatchability. A lack of it is indicated by slow growth. It is present in milk and its by-products, and in lucerne and other legumes both green and dry. Yeast is very rich in vitamin G.

DAIRY TESTS AND CALCULATIONS.

(Concluded.)

By F. A. Lammas, Dairy Officer.

6. Test for Strength of Rennet.—In this Colony where the "Marshall Rennet Test" is used extensively it is imperative that the rennets used be of uniform strength. If this is not the case the cheese manufactured cannot be expected to be of uniform quality. One part of standard rennet should coagulate 10,000 parts of normal sweet milk at 95° F. in 40 minutes.

Mix thoroughly 1 cubic centimetre of the rennet to be tested with 9 cc.'s of distilled or rain water. Carefully measure 100 cubic centimetres of perfectly normal sweet milk and adjust the temperature to 95° F. Stir thoroughly into the milk 1 cubic centimetre of the rennet solution and note carefully the time the rennet is added. If the rennet is of standard quality, first signs of coagulation should appear in 4 minutes, but provided coagulation does not take longer than 5 minutes the rennet is of sufficient strength for the usual cheese-maker's requirements.

7. The Hot Iron Test.—This test is employed by cheesemakers to ascertain the maturity of the curd, and with its aid the time to draw the whey and mill the curd may be judged. An iron about 30 in. long is heated at one end to just short of redness, when it is carefully wiped with a cloth until it is clean and smooth. A small quantity of curd is placed in a dry cloth and squeezed in the hand until most of the whey has been expelled and the surfaces have been wiped dry. The curd is then gently pressed against the iron where it is hot enough to cause it to stick, but not sufficiently hot to burn or scorch it. When the curd has stuck fairly firmly it should be gently drawn away from the iron and if

any acidity is present, silk-like threads will appear between the curd and iron. The length of these fine threads denote the maturity or ripeness of the curd.

Depending upon climatic conditions and the length of time the cheese is intended to ripen, ¼ in. threads denote the time for drawing whey, and threads 1 in. to 1½ ins. the time to mill the curd.

The longer the threads drawn, the greater the acidity indicated. A quick ripening cheese requires less acidity at milling time than does a cheese intended to ripen slowly.

8. To Find the Weight of any Milk Constituent when the Weight of the Milk and the Percentage of the Constituent are Known.—The formula here is to multiply the weight of the milk by the percentage of the constituent and divide the product by 100.

Example.—How many pounds of fat are there in 48 lbs. of cream testing 38% butterfat?

$$\frac{48 \times 38}{100} = 18.24 \text{ lbs. fat.}$$

9. To Find the Percentage of any Constituent in Milk or Milk Product when the Weight of the Milk or Product and the Weight of the Constituent are Known.—In this instance we multiply the weight of the milk constituent by 100 and divide the result by the weight of the milk.

Example.—What is the percentage of fat in 140 lbs. of cream containing 56 lbs. of fat?

$$\frac{56 \times 100}{140} = 40\% \text{ butterfat.}$$

10. Fining the Over-run.—The amount of butter manufactured from a given quantity of cream is greater than the amount of butter fat contained in the cream, because butter in addition to fat contains water, curd and salt.

This excess is termed the "over-run," and may easily be ascertained by subtracting the weight of fat in the cream

from the weight of butter manufactured. This result, however, expresses the over-run for a given amount of butterfat, whereas the figure representing the over-run is usually expressed as a percentage. In order to find the percentage over-run, subtract the weight of butter fat in the cream from the weight of butter manufactured, multiply the product thus obtained by 100, and divide the result by the weight of butterfat.

Example.—A batch of cream containing 140 lbs. butterfat is churned and yields 170 lbs. of butter, what is the percentage over-run?

170 lbs. butter, minus 140 lbs. fat; 30 lbs. butter over-run.

$$\frac{30 \times 100}{140}$$

= 21.4% over-run.

11. To Find the Yield of Butter.—To find the amount of butter that should be made from a given amount of cream when the butterfat content is known, and the percentage over-run is estimated:—

Add 100 to the estimated over-run figure, multiply the product by the weight of butterfat in the cream and divide the result by 100.

Example.—How many pounds of butter should be made from a certain amount of cream containing 120 lbs. of butterfat, when it is calculated that the over-run should not drop below 18 per cent.?

$$\frac{118 \times 120}{100}$$

= 141.6 lbs. of butter.

12. To Find the Average Percentage Butterfat of Different Lots of Milk.—First determine the weight of butterfat in each lot of milk (rule 8), multiply the weight of the total butterfat content of all the milk by 100 and divide the product by the total weight of milk.

Example.—If the undermentioned lots of milk were mixed, what would be the average percentage butterfat?

Sample.	Lbs. Milk.	% B.-Fat.	Lbs. Fat in Milk.
1	150	4.0	6.0
2	300	3.0	9.0
3	800	5.2	41.6
4	100	3.1	3.1
Total weight of milk.	1,350		59.7 Total fat in milk.

$$\frac{59.7 \times 100}{1,350}$$

Average 4.4% butterfat.

The average percentage of butterfat in different lots of milk is frequently estimated by adding the percentage of fat in each and dividing the total by the number of lots of milk. Thus, in the sample given above, the result would be 3.8% butterfat (4.0 + 3.0 + 5.2 + 3.1 ÷ 4). This method, however, is inaccurate, unless the amounts of milk in each lot represented are equal.

13. Standardising Milk and Cream for the Making of Ice Cream.—The necessity for standardising cream for the "mix" when the ice cream is required to be of a certain butterfat consistency is becoming more apparent daily.

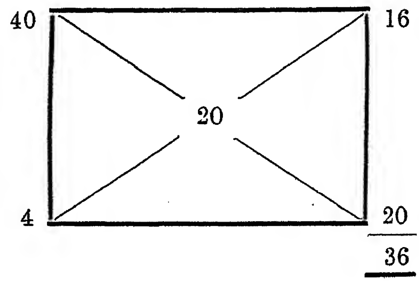
A simple and accurate method of determining the relative amounts of two milks or creams to be mixed in order to obtain the desired fat consistency is as follows:—

Draw a square as illustrated below, and in the centre place the desired fat consistency, and at the two left-hand corners the percentage of fat in the two liquids to be mixed.

Then find the difference between the figure in the centre and that at the top left-hand corner, and write the result at the bottom right-hand corner. Similarly, at the top right-hand corner place the difference between the figure in the centre and the figure at the bottom left-hand corner.

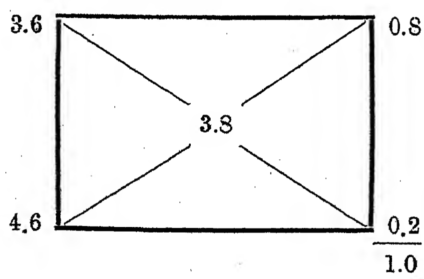
The number at the top right-hand corner indicates the amount of milk or cream, whose fat percentage is placed at the top left-hand corner, which should be mixed with the amount of milk or cream indicated by the number at the bottom right-hand corner, whose fat percentage is stated at the bottom left-hand corner.

Example (1).—Suppose we have cream testing 40 per cent. butterfat and milk testing 4 per cent. butterfat, and it is desired to mix the two in such proportion so as to produce cream testing 20 per cent. butterfat. Following the above rule:—



The above diagram illustrates that 16 lbs. of 40 per cent. cream when mixed with 20 lbs. of 4 per cent. milk will produce 36 lbs. of cream testing 20 per cent. butterfat.

Example (2).—It is desired to mix milk testing 3.6 per cent. butterfat with milk testing 4.6 per cent. butterfat, so as to obtain 200 lbs. of milk testing 3.8 per cent. butterfat. The diagram appears as follows:—



For convenience, the decimal point may be discarded, and 200 lbs. of milk testing 3.8 per cent. butterfat made up by mixing 8-10ths or 160 lbs. of milk testing 3.6 per cent. butterfat with 2-10ths or 40 lbs. of milk testing 4.6 per cent. butterfat.

14. To Change Degrees Centigrade to Fahrenheit.—Multiply the centigrade reading by 9-5ths and to the result add 32.

Example.—Change 55° centigrade to corresponding degrees Fahrenheit:—

(9-5ths x 55) plus 32 = 131°F.

15. To Change Degrees Fahrenheit to Centigrade.—Subtract 32 from the Fahrenheit reading and multiply the result by 5-9ths.

Example.—Change 55° Fahrenheit to corresponding degrees centigrade:—

(95 - 32) x 5-9ths = 35°C.

Note.—The centigrade thermometer is seldom employed in dairying, the Fahrenheit thermometer being more commonly made use of.

Water freezes at 0°C. and boils at 100°C.

Water freezes at 32°F. and boils at 212°F.

16. To Fumigate the Cheese Curing Room.—For every 1,000 cubic feet air space, 3 pints formalin and 23 ozs. potassium permanganate are required. In the curing room place an ordinary petrol tin in a much larger vessel containing a little water. The permanganate is then placed in the petrol tin and the correct amount of formalin added. Close and seal the room for six hours.

17. To Remove Taints from the Ice Chamber or Dairy.—Heat three or four bags of charcoal by standing in the sun for several hours. Then place the bags in the room to be treated and leave over night for the charcoal to absorb the taint.

The majority of taints can be removed in this manner by alternately heating the charcoal and placing in the room.

Lime has also proved effective for this purpose. Place several basins containing a little water in the infected room, to each basin add a handful or two of lime. Stir the solution occasionally, and, if possible, keep the doors and windows open to create a draught.

18. Simple Test for Dairy Salt.—Dissolve a little of the salt to be tested in distilled water and examine the solution for insoluble impurities. Good dairy salt should contain little or none. To this solution of salt add a little strong ammonia; the formation of a white flocculent precipitate indicates magnesium. Good dairy salt should give no reaction to ammonia.

TOBACCO CULTURE IN SOUTHERN RHODESIA.

THE HARVESTING AND CURING OF VIRGINIA TOBACCO.

By D. D. Brown, Chief Tobacco Expert.

The operations of harvesting and curing are of supreme importance to the tobacco grower when viewed from the standpoint of financial return. The value of the tobacco is dependent upon quality, and unless proper care is exercised during the harvesting and curing stages, the financial returns may be seriously reduced through lack of quality in the cured leaf. Mistakes in either operation cannot be rectified when once made. The question of quality is of primary importance and it will become increasingly so with the growth of intensive competition with other tobacco-producing countries.

Ripening Stage.—The young tobacco plant, when growing vigorously, carries leaves of a deep green colour, which at this stage are soft and pliable. This intense green colour indicates a rich supply of nitrogenous constituents, which go to make up the vital or living parts of the leaf, and which are necessary for the building up of the food supply of the plant.

At about the time the leaves as a whole have reached their maximum power of elaborating the food supply, the flower head begins to develop. This food supply, consisting of starch and other similar substances, is carried from the leaf into the seed head to furnish the necessary food for the development of the seed. This accomplished, the leaves have completed their full task, and they now pass into the period of gradual decay. In practice, however, the tobacco plant is "topped" so that the seeds are not allowed to develop.

Making a last effort to reproduce itself, the plant then sends out secondary shoots or suckers, but these, too, are removed by the grower. Under these circumstances the food supply elaborated by the leaves is not translocated to other parts of the plant, but accumulates in the leaves themselves. The result is that the leaf increases both in size and in body. The accumulation of plant food in the leaf induces ripeness, and later, unless the leaves are harvested, gradual decay. Should the plants make normal progress, the usual period required for the lower and middle leaves to ripen is about 90 days from the date of setting out in the field, the uppermost leaves ripening later.

Actual and personal experience is required before the grower is fully able to tell when the leaf is properly ripe, but the following explanation of the indications may prove of some assistance.

The first indication of ripeness is a pronounced change in colour, provided this change is not caused by conditions other than maturity in the plant. In seasons of severe drought or extreme wet the leaves will often turn yellow before the plant is fully ripe. Plants affected by disease will also change colour prematurely; root-gall is another common cause of this condition. The leaves of plants thus affected will not cure properly, and will lack the necessary quality.

The dark green colour of healthy, light-textured leaf changes by gradual degrees to a greenish yellow as the leaf reaches maturity, whilst in the case of heavy-textured leaf the change to a yellow colouration may be confined to only small areas of the leaf-surface and causing the ripe leaf to appear with yellow flecks or spots. A sign of ripeness in very heavy tobacco is to be found in the way the tips of the leaves curl in towards the stalk of the plant. The accumulation of starch granules within the leaf cells causes the leaf to become brittle and roughened; this change from being pliable and smooth to the touch is another indication of ripeness. Such leaf will crack when folded and pressed between finger and thumb.

Before being harvested, the tobacco leaf must be suitably ripe, and it is essential that the greatest care be exercised in picking leaf which is suitably ripe for the method of curing to be employed.

The correct degrees of ripeness desirable for each method of curing are:—

Air curing—almost fully ripe leaf.
Sun curing—almost fully ripe leaf.
Flue curing—fully ripe leaf.
Fire curing—fully ripe leaf.

Many a promising crop of tobacco has been ruined in the harvesting and curing stages. A fairly common source of financial loss to tobacco growers is due to the practice of harvesting leaf which is unripe. Optimum results in the curing process depend upon certain factors, the correct stage of ripeness of leaf being one of the most important.

Harvesting.—Tobacco may be harvested by cutting down the whole plant or by the removal of individual leaves. The former method is generally employed in the case of sun-cured, air-cured and fire-cured tobacco. It is an economical method as regards labour requirements, but has the drawback that all the leaves on the plant are not in the same state of ripeness when harvested.

Flue-cured tobacco is harvested by the single leaf method as this system has proved to be particularly suitable and renders easier the filling of the barn with leaf uniform in ripeness and texture. In order to harvest all the leaves produced, it is necessary to take from three to six pickings off the plant.

When harvesting by the whole plant method it is advisable to use a proper tobacco knife (see figure 1) to split the stalk down the centre to within about six inches of ground level; then, after holding the plant slightly down and away from the operator a slanting cut severs the stalk from the root. The plants are then allowed to wilt slightly, after which they are placed astride the curing sticks; one such stick will hold from six to ten plants, depending upon their size. The sticks, when filled with their complement of plants, are next placed on a trolley to be conveyed to the barn or curing racks as the case may be. The tobacco should be carefully handled, otherwise the leaves may become bruised and damaged.

In the single leaf system of harvesting, leaf of uniform ripeness is picked and then placed either in crates, baskets, "machilas," or sleighs specially constructed for the purpose.

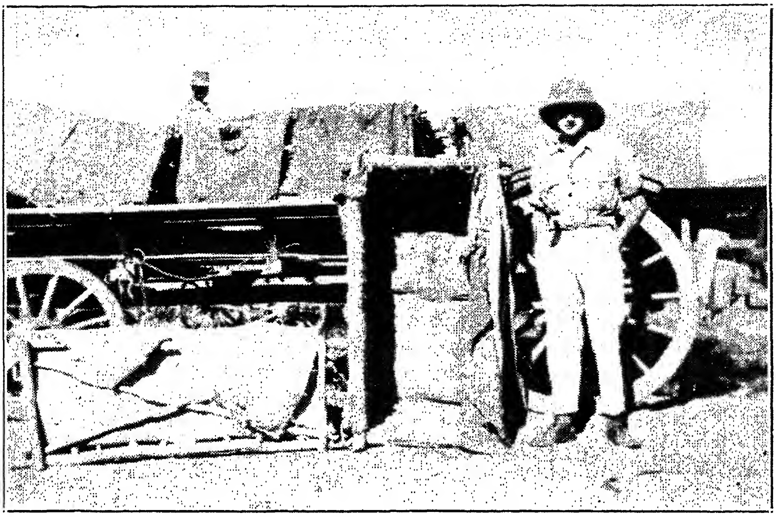


Fig. 3. Harvesting crates.

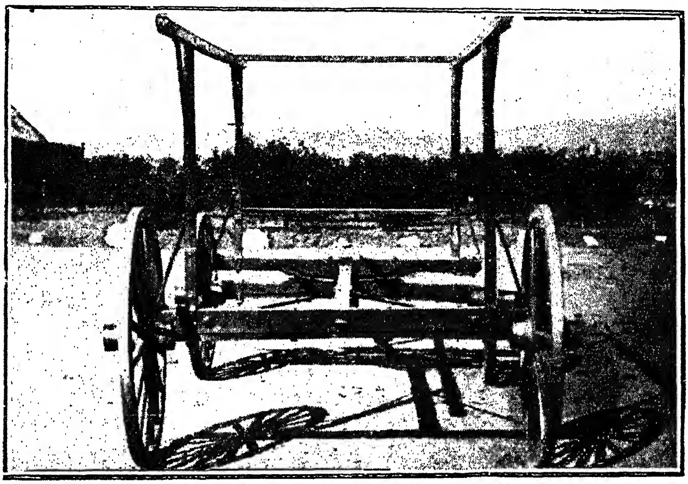


Fig. 4. Specially constructed trolley for carting tobacco on sticks.

Fig. 6. A heavy yielding crop of tobacco.

A very suitable receptacle made and used by many tobacco growers is a contrivance manufactured from ordinary bush poles and hessian. The frame is made of poles (about 4 inches in diameter), the two top members extending about 12 inches beyond the ends of the crate and serving as handles by which the receptacle is carried. For convenience in stowage the fixed handles might be replaced by detachable poles of the requisite dimensions passed under the top bars at either end and held in position by wire loops fixed at the four top corners. One set of such handles will serve for a number of these crates. A similar arrangement can also be applied to the iron crates now manufactured and sold by local firms.

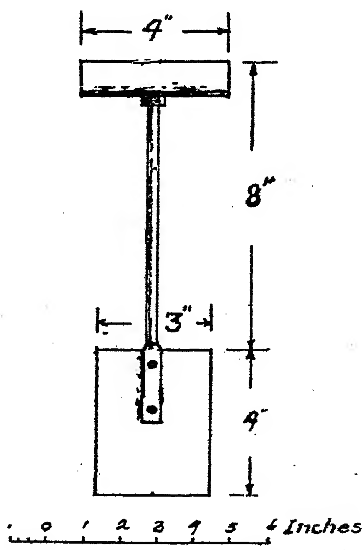


Figure No 1

Laths are placed across the bottom of the framework to prevent the hessian sagging when the crate is filled with leaf. The sides and ends are diagonally stayed with heavy gauge galvanised wire. Hessian is sewn inside the framework to cover the bottom, sides and ends of the crate. A loose flap is also sewn along the top of one side, and is used to cover the tobacco to protect the leaf from sun-burn.

These crates are carried about the field, and, when filled, are loaded, one on top of another, on a wagon. Individual

crates may also be placed on a sleigh, and drawn to and from the field in this fashion. The containers holding the leaf are next carted to the stringing shed, which is situated in close proximity to the curing barns. Care should at all times be exercised in the handling of the leaf, in order to prevent mechanical damage. Careless handling during the harvesting is responsible for much injury, due to the leaves becoming bruised and sunburned, and no matter how well the curing process may be carried out, it is impossible to repair this damage.

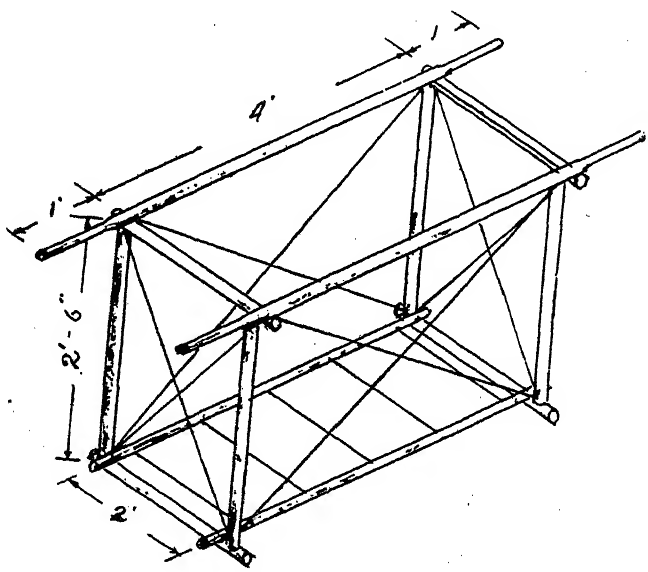


Fig. 2. Tobacco crate, showing method of construction.

In the stringing shed the containers are carefully emptied, the tobacco being placed on tables or in small heaps close to the natives tying the leaves on to the sticks. These sticks are supported at each end by a post let into the floor, and are some three feet high above floor level. The leaves are tied up in bunches of two to five leaves (according to the size of leaf).

Cotton string is used for tying the tobacco, one end of the string being securely tied to an end of the curing stick before the operator commences to deal with the leaf. The

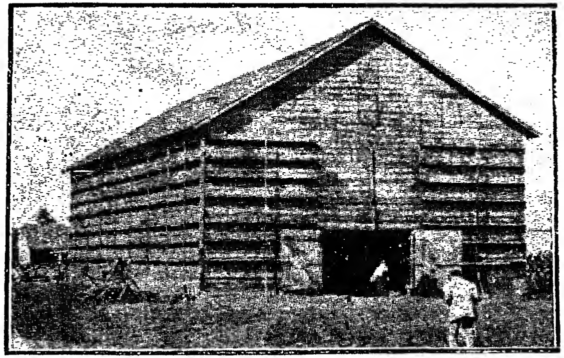


Fig. 7. Type of barn used for air curing in America.

Fig 8. Air curing shed, Transvaal. Note absence of sides and tobacco exposed to the weather.

Fig. 9. American type of barn used for dark fire cured tobacco.

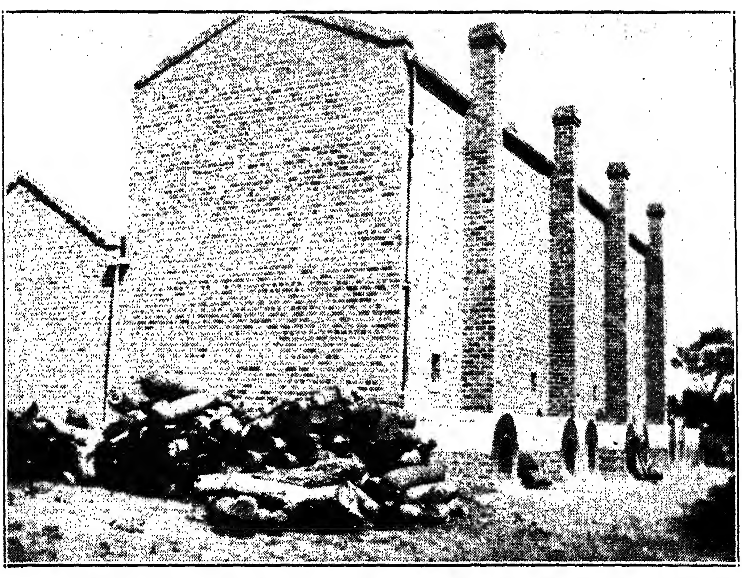


Fig. 10. Tobacco barns, showing local type of brick furnace.

string is held in one hand, and with the other a bunch of leaves is placed in position close to the stick. The string is then wound round the leaves (not more than one inch from their "butts") one and one half turns before they are passed completely over and across the stick to complete the operation. In tying the leaves the string should always be wound round in the direction away from the operator. The next bunch of leaves is placed on the opposite side of the stick in order that the alternate bunches will balance the stick when filled.

When a sufficient number of bunches has been placed on the stick (usually 32 bunches), the free end of the string is wound round and tied to the end of the stick, which is then ready for hanging in the curing barn.

In cured tobacco the colour, texture and quality of the leaf are the important features. When harvested before the proper time the leaf will retain a green colour and if picked when over-ripe the colour will be uneven and blotchy, besides being harsh and lacking in quality. Leaf which cures out a deep green colour is of little or no commercial value, so if an error is to be made, it is better to err on the side of picking over-ripe leaf rather than green leaf, for over-ripe leaf has some commercial value when offered for sale.

For flue-cured tobacco it is essential to fill each curing barn with leaf in the same state of ripeness, for when tobacco in varying stages of ripeness is placed in the barn, all of the leaf will not cure at the same rate, and will, therefore, not be uniform in colour when cured. The leaf filled into each barn should also be of uniform texture for the same reason. Close personal attention to these details is required from the grower if a frequent cause of serious loss is to be avoided.

Curing.—It is estimated that approximately 80 per cent. of the total weight of tobacco as harvested is comprised of water.

In the curing process this moisture is gradually expelled from the tissue of the leaf, and certain chemical and physiological changes take place which bring about the formation of those desirable qualities in properly cured tobacco.

During curing the leaf is subjected to a gradual starvation, regulated by certain conditions. If by means of excessive heat or protoplasmic poisons the cells are prematurely killed,

the leaf will not be properly cured, and will consequently lack in essential qualities. The principal factors by which the curing is controlled are heat and moisture. There are four methods of curing tobacco in general use, viz., air-curing, sun-curing, fire-curing and flue-curing, and the conditions for one method may not be applicable to another.

The purpose for which the tobacco is to be used, as well as the climatic and soil conditions under which it has been grown, largely determine the method of curing. The abbreviated list given below indicates the several methods of curing, and the types of tobacco cured by each method:—

Air-cured—	
Cigar tobacco Burley Stemming Transvaal tobacco Australian tobacco	Cigars, pipe mixtures, chewing, snuff and cigarettes.
Sun-cured—	
Turkish Maryland Virginia Rhodesian Indian	Cigarettes, smoking and chewing.
Fire-cured—	
Virginia dark Kentucky dark Tennessee dark Nyasaland dark Rhodesian dark Canadian dark Uganda dark	Chewing, smoking, snuff and cheap cigars.
Flue-cured—	
Virginia bright Carolina bright Nyasaland bright Rhodesian bright Canadian bright Indian bright Australian bright Transvaal bright	Cigarettes, pipe mixtures, chewing and snuff.

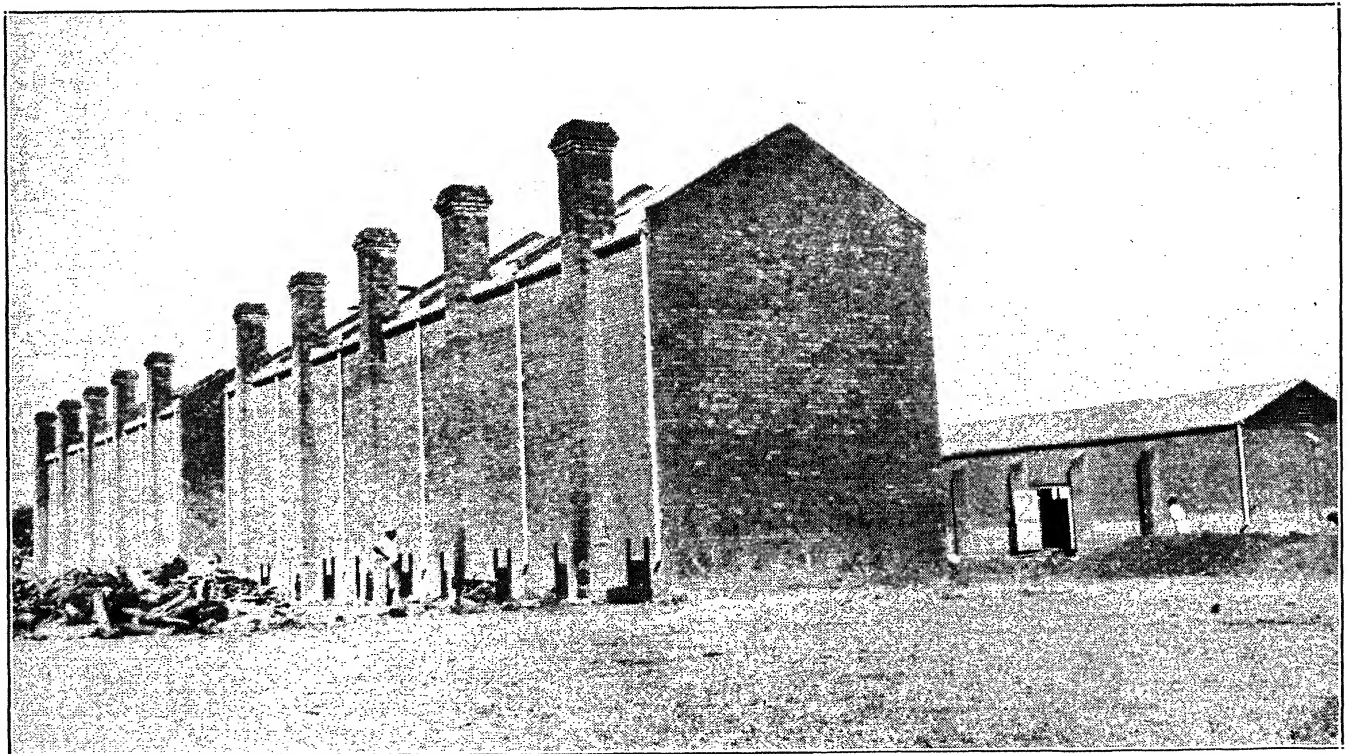


Fig. 11. Tobacco barns and grading shed.

Air Curing.—This method of curing is the simplest, and is very extensively employed; a great part of the world's tobacco supply is thus cured. Air curing is a natural process, for the tobacco is harvested and placed in the barns to be cured by natural atmospheric conditions. The results obtained are dependent upon climatic conditions, and if the conditions are ideal, and proper care has been taken in harvesting, the tobacco will cure out well.

In order to overcome the effects of unfavourable weather conditions on the curing, growers have of recent years introduced artificial means (heat and moisture), which somewhat modify the process.

When an excessively dry and hot spell sets in immediately after the tobacco is placed in the barn, the curing is rendered difficult and unsatisfactory, as the leaf may be killed prematurely, thus causing poor colour and a lack of desirable qualities. When wet weather prevails, heavy loss may be caused through "pole-sweat," and the colour of the leaf may be adversely affected. The ideal climatic conditions for air-cured tobacco are obtained when the weather is calm and clear, with a shade temperature of from 80 degrees to 90 degrees F., and a moderately dry atmosphere. When the above conditions obtain, the moisture given off from the leaf is readily absorbed by the atmosphere, thereby lessening the chance of oxidation taking place. Under ideal conditions the bulk of the leaf should cure out a moderately bright colour.

The occurrence of wet weather during the final stages of curing and before the tobacco is removed from the curing shed, will cause the leaf to turn red. Normally the time required for air curing is from between six weeks to twelve weeks, depending upon the nature of the tobacco and the climatic conditions prevailing during the curing process. When the single leaf method of harvesting is employed the curing will take less time than would be required in the case of curing the whole plant.

The purpose for which the tobacco is to be used in a great measure determines what the desirable colour of the leaf should be. For cigarette purposes the leaf should be lemon yellow to light orange in colour, whilst leaf for pipe mixtures, plugs and twists will range from light red to dark

brown. In the case of cigar tobacco the most desirable colours are brown and olive shades.

Normally, all leaf turns a yellow colour before it begins to dry out. If it dries before yellowing, it will remain a green colour, and consequently be of little or no commercial value. When the drying is delayed too long after the yellow coloration appears, oxidation takes place, and the leaf will turn a reddish or brownish shade.

When filling the curing shed the sticks of tobacco are hung up on tiers, starting from the topmost tier and working down to the lowest. Much damage may be caused through placing sticks, holding the entire tobacco plant, in the wrong order. Any one tier should not be filled before another is commenced. The correct procedure is first to place one stick on the highest tier. The following stick is placed on the next tier down, with the butts of the tobacco plants just touching the tips of the plants suspended from the stick above. The next stick should then be hung on the third tier down, and placed in similar relation to the stick above, as indicated for the first and second sticks placed in the barn. This order of filling is continued until the bottom stick has been suitably placed on the last tier, when the same order is observed by commencing again at the top and working downwards as before. This is continued until one section or "room" is filled. Each section is completed in proper sequence until the barn is fully packed. The filling of a barn should be commenced at a point furthest away from the door, leaving that section by the door until last.

At first the tobacco sticks are placed along each tier at intervals, which allow the plants to touch, but they must not be in too close contact. The usual spacing allowed is about six to eight inches, depending upon the length and girth of the plants. Later on, when the tobacco is well yellowed in the barn, the spacing between each stick may be increased in order to hasten the drying process. During excessively dry weather the sticks of tobacco should be kept closer in order to prevent the leaf drying out too rapidly, and to enable it to turn a suitable yellow colour.

The atmospheric conditions in the barn should be so controlled that the relative humidity is fairly high during the

wilting process, the wet bulb of the hygrometer registering between 2½ degrees to 3 degrees below the dry bulb. If the difference in reading between the wet and the dry bulbs be greater than 3 degrees, more moisture should be introduced into the barn. On the other hand, should the difference be less than 2½ degrees, the humidity must be reduced by ventilation or by heating. The temperature of the barn should be maintained at from 70 degrees F. to 75 degrees F. during the wilting process. When the tobacco has changed to a pale greenish-yellow tinge the temperature should be increased to 80 degrees F. and then to 90 degrees F. The relative humidity should be decreased in order to allow the leaf to commence drying. Care must be exercised at this critical stage in the curing otherwise the tobacco may become spoiled either through drying too quickly and remaining green or through excessive moisture and delayed drying causing sponging and, in extreme cases, pole-burn.

After the leaf has yellowed the rate of drying should be gradually increased by use of ventilators. In barns fitted with flues the curing may be hastened by lighting the fires. Another method of curing is possible by removing partially cured tobacco from the air-curing barn and completing the curing process by the sun-cured method.

As an alternative a combination of the air-cured and sun-cured methods may be adopted. The tobacco is first placed in the air-curing barn and is wilted and yellowed in the usual manner, after which it is removed from the barn and the curing process is completed by the sun-cured method. The partially cured tobacco is conveyed to the curing racks, where it is exposed to the direct rays of the sun until the leaf is thoroughly dried out.

Speaking generally, climatic conditions during the early part of the season are not conducive to good results, and if air curing were to be properly developed in Southern Rhodesia it would be necessary to utilise suitable air-curing barns. In other countries where this method of curing is practised the barns are both elaborate and costly. The erection of grass sheds in which the tobacco is more or less exposed to the elements cannot be recommended and disappointing results may be expected.

Sun Curing.—Sun curing is similar to air curing, in that no artificial heat is employed. In other features, however, it differs. In this method the rate of curing is hastened by exposing the leaf to the direct rays of the sun, whilst in air curing the curing is primarily regulated by atmospheric conditions.

In addition to a packing shed, bulking shed and conditioning pit (all of which are necessary on any farm where tobacco is produced), a wilting room and curing racks are necessary equipment.

The wilting room is used for yellowing the leaf before the tobacco is placed out on the drying racks. A suitable room is fairly dark and cool, and besides being used for wilting, may also serve for conditioning the cured leaf.

The packing shed should be furnished with roof lights, as this means of lighting is more satisfactory than when side windows only are employed. Grading of the leaf can be done in this building, besides the baling of the leaf after grading.

The bulking shed requires no elaborate lighting, but should only have sufficient light to enable the bulking operations to be properly carried out.

The drying racks are made from native timber or native timber posts and plain heavy gauge galvanised wire. In the former case, posts are set into the ground, and the light sticks, forming the rails, are attached to them; while in the latter case, the wire forms the rails in place of the light sticks. The conditioning pit is used for softening the cured leaf.

The dry leaf is placed in the pit, and after hanging there for a time, the web of the leaf will have absorbed sufficient moisture to make it pliable and fit for handling without breakage. A suitable pit is made by digging a rectangular hole in the ground and roofing it over with grass or reeds and earth. Where grass is employed, a pitched roof should be built. The site selected for the conditioning pit should be one where water will not seep through to such an extent that the pit will be flooded.

In sun curing, the whole plant is usually harvested, but the single leaf method may also be employed, especially where

the leaf is to receive the final stages of curing in a flue-curing barn. The usual practice followed in sun curing is to harvest the tobacco just before it is fully ripe. The plants, after being placed on sticks, are put into the wilting room until the leaf turns a greenish yellow. When the leaf is properly yellowed it is removed from the wilting room and placed on the drying racks, where it is exposed to the direct rays of the sun until both the web and midrib are thoroughly dried out. The time usually required for sun curing is from four to six weeks. Some means of covering the tobacco on the curing racks is required for use during the night, and in the event of rain, during the day. The tobacco may be covered with bucksails, hessian or grass mats. After the tobacco has been on the racks from four to six weeks, it should be ready for removal to the conditioning pit. The removal of the cured tobacco from the racks should be carried out, if possible, when there is a certain amount of moisture in the atmosphere, either during misty weather or early in the morning before the heat of the sun dissipates the moisture absorbed by the leaf overnight.

A great deal of damage may be caused through handling the cured leaf when it is in a brittle condition. It is usual, therefore, to wait until the leaf absorbs sufficient moisture from the atmosphere, when climatic conditions are favourable, before removing the tobacco from the curing racks.

Where it is absolutely essential to have the tobacco removed from the racks within a certain time, growers may sometimes resort to the expedient of taking down the sticks from the racks about sundown, and placing them flat down on the grass, where, by leaving the tobacco fully exposed to the dew overnight, the leaf will become soft enough for handling by sunrise the next morning. Should the dews be heavy, the tobacco will lose colour through becoming wet, so this practice is not to be recommended, except in cases where it is imperative to have the tobacco removed from the curing racks within a certain time.

In order to assist in the production of good quality sun-cured leaf, the crop should not be planted too early in the season, but it should be transplanted so that it will be ready for harvesting about the time when the rains normally cease.

The sun-curing method can be recommended where soil and climatic conditions are suitable for the production only of a heavy type of tobacco.

Plants producing leaf too heavy for flue curing satisfactorily may be found in many fields of flue-curing tobacco, especially round ant-heaps. The leaf of such plants should first be wilted, and may then be sun cured until the leaf is dry. It should then be placed in the flue barn, and the midrib dried out.

Sun-cured tobacco differs somewhat from air-cured leaf, and possesses certain desirable qualities. It is usually lighter and more uniform in colour, and is sweeter and more aromatic. This type of leaf is used for chewing and for pipe mixtures.

Fire Curing.—This method of curing tobacco calls for the use of fire during the curing process. Heat is applied by means of open fires placed in trenches directly beneath the tobacco. The smoke from the burning wood imparts a creosotic flavour and peculiar aroma, besides improving the keeping qualities of the cured leaf.

The production of this type of tobacco can only be recommended where soil and climatic conditions are suitable for the production of a heavy type of leaf. The quality of the tobacco should be of a high standard.

For fire curing, suitable barns are required. Plans and specifications of such barns are contained in Bulletin No. 617.

Tobacco to be cured by this method should be heavy bodied, smooth textured, with large oily leaf rich in nitrogenous constituents. The soil for the production of tobacco suitable for fire curing should contain high percentages of humus, clay and silt, and be naturaly fertile and well drained. Liberal applications of kraal manure or fertilisers should be used in order to further increase the growth of the plant. When fertilisers are used, the nitrogen contained therein should be mostly derived from an organic source, such as fish meal. The plants are topped low in order that only large leaf is produced.

The plant is not harvested until it has become fully ripe, the whole plant method being practised as described under "harvesting." After the tobacco has been placed on the

sticks and been allowed to wilt slightly, it is carted to the barn and placed on the tiers. In filling the barn the proper procedure is to place the first stick of tobacco on the top tier, then the next stick on the second tier, and so on, until the bottom tier is reached. This procedure is repeated until that room or section of the barn is completely filled with tobacco sticks. The sticks are spaced at six to nine inch intervals along the tier, care being taken not to crush the tobacco leaves between the sticks, or to damage the tobacco by placing the next stick directly beneath those plants hanging on the tier above. After the tobacco has been hanging in the barn for a period of from four to six days, the leaf should be yellow, and when the tobacco has reached this stage, small fires are lighted in the trenches dug in the floor of the curing barn, and the temperature of the barn is gradually increased to about 100 deg. F. This temperature is maintained until the tip and edges of the leaf begin to curl and turn brown, when the fires are put out and the barn allowed to cool down; this will allow the sap to become uniformly distributed through the leaf, and the brownish parts of the leaf become pliable. The fires are then restarted, and the temperature raised to a few degrees higher than during the preceding stage.

When the brown colour begins to spread from the edges of the leaf towards the midrib, and the brown coloured part of the leaf becomes brittle, the fires are again removed to allow the barn to cool down and the sap to spread. This process is repeated, and as the curing progresses the temperatures are increased each time after the fires are restarted.

It is seldom advisable to raise the temperature higher than 125 deg. F. The cured leaf should be of good size and body and a uniform dark brown colour.

The desirable qualities of the cured leaf may be seriously affected through being subjected to excessive quantities of smoke, which may leave heavy deposits on the leaf and blacken the tobacco to a great degree. Certain wood gives off an unpleasant odour when burned, and should this be taken on by the tobacco, it is undesirable.

The fuel used for burning in fire-curing barns should be selected from hard woods which do not create any unpleasant smell whilst burning.

After the curing is completed, the tobacco is brought into condition in a similar manner to that already described under air and sun curing. The leaves are then stripped from the stalk, graded according to size and colour, tied up into hands, and bulked preparatory to baling.

The time taken for fire curing is between two and three weeks, according to the size of the tobacco and climatic conditions. Should the curing be carried on at too fast a rate, the quality of the leaf will be of low grade and little commercial value.

Flue Curing.—This is the method generally used by the growers of tobacco in Southern Rhodesia, and for which the majority of the tobacco produced is most suited. The rate of curing in this method depends upon the use of artificial heat, and the process calls for specially designed barns. Specifications and plans of suitable flue-curing barns have previously been published in this Journal, and reprinted as Bulletins Nos. 605 and 661.

Heat is generated in the furnaces by means of wood fires, and flues radiate this heat into the barn. Coal may also be used in properly constructed furnaces.

Flue curing is the most modern method of curing tobacco, and requires constant and careful attention to all details connected with it. The skill and care exercised during the curing have a direct influence on the value of the tobacco produced. The colour most sought after is a clear lemon yellow, and this leaf brings the highest price. Varied colours are found in every barn cured, and green is the colour least desired. Care in picking will considerably reduce the quantity of green-coloured leaf. Leaf which gives the best results is fine textured and silky. *There are many formulas advanced for this method of curing, and any one may be correct under certain conditions, but they cannot all be correct at one and the same time.* The type of leaf and the climatic conditions obtaining during the process will largely regulate the rate of curing. For instance, heavy leaf will be longer in curing than light leaf, and leaf which is yellow when picked will cure faster than green-coloured leaf. Higher temperatures are required in wet weather than

in dry weather, and lower temperatures are required in cool weather than in warm weather.

The state of the atmosphere outside the barn has also to be considered in regulating the ventilation of the barn during the time the tobacco is being cured. A dry outside atmosphere calls for reduced ventilation through bottom ventilators, and the top ventilation should also be reduced to a minimum, so that the leaf will not dry out too rapidly and possess an undesirable green colour.

During wet weather the bottom ventilation is reduced and top ventilation is increased, in order that the moisture-laden air may be driven out of the barn.

During excessively wet spells, and when the leaf is heavy bodied and contains a good deal of moisture, it may sometimes be advisable to open slightly the top ventilators, when the temperature in the barn reaches 105 deg.-110 deg. F., and by this means reduce the amount of "sponging" which often takes place when the barn is kept closed, until a temperature of 115 deg. (the temperature to be reached before ventilation is recommended under normal conditions) is registered within the barn.

In the event of conditions requiring the above system of ventilation, the top ventilators are at first opened to a very small degree, and the opening gradually increased in order to drive off the excess moisture from inside the barn. The bottom ventilators should be kept closed at this stage of the curing, or only a very limited amount of ventilation allowed, as excessive ventilation through the bottom vents would defeat the object in view by introducing a fresh stream of moisture-laden air into the barn.

In flue curing there are three distinct stages through which the leaf must pass, namely, yellowing the leaf, fixing the colour, and drying the leaf and midrib. In Rhodesia the single-leaf method of harvesting is used, but in other countries, where the whole plant is put into the flue-curing barn, a fourth stage is required, namely, the killing of the stalk.

Yellowing Stage.—The barn is filled with leaf of the same texture and ripeness. The filling of the barn should be accomplished in one day, so as to assist the tobacco to

cure evenly. A thermometer and hygrometer are suspended from the bottom tier in the middle of the barn; a suitable thermometer should be graduated in single degrees up to 170 deg. F. The hygrometer has both a wet and dry bulb; the latter should have the water receptacle filled with water when placed in the barn. As soon as the barn has been filled, the door and ventilators are closed to prevent the escape of moisture. Small fires are then made in each furnace, and these are increased in size until the temperature of the barn is raised to 90 deg. F.

In the early stages of curing, a low temperature is essential until the leaf yellows; a high temperature at this stage would ruin the tobacco. The temperature is therefore kept at 90 deg. F. until the leaf starts to yellow at the tips and round the edges. This having occurred, the temperature is gradually raised to 95 deg. F., and this temperature maintained until the yellow colour begins to spread in towards the midrib of the leaf. The temperature is then increased gradually to 100 deg. F., and maintained at this temperature until the yellow colour is more pronounced.

During this time, the atmosphere of the barn should be saturated to prevent the leaf from drying out. Enough moisture must be kept in the barn to give a reading of 3 deg. or 4 deg. difference between the wet and dry bulbs of the hygrometer; the wet bulb should only register 3 deg. or 4 deg. below the temperature recorded on the dry bulb. When the wet bulb registers more than 4 deg. below the dry bulb, the indication is that the atmosphere within the barn is becoming too dry, and should this be the case, it will be necessary to introduce more moisture into the barn by pouring water on the floor and lower walls. In place of water, low-pressure steam may be introduced until the required degree of humidity has been attained.

When the leaf begins to show more yellow in colour, the temperature is increased to 110 deg. F., and this heat maintained until the leaf is yellow, with only a slight greenish tinge. The temperature is then gradually raised to 115 deg. F., and held there until the proper yellow colour is obtained. Between the temperatures of 100 deg. F. to 115 deg. F., the amount of moisture in the atmosphere of the barn is

gradually reduced until the wet bulb registers from 6 deg. to 7 deg. below the dry bulb. Maintaining the correct amount of moisture in the barn during this stage is very important.

Fixing the Colour.—This is the most critical stage in the curing, and it is here that many a barn of good tobacco becomes spoiled. The greatest care in the manipulation of the barn is required at this period of curing. The leaf will turn a reddish brown colour if the atmosphere of the barn is too humid, or if the ventilation is inadequate and the temperature is not increased fast enough. This discoloration of the leaf is known as "sponging," and is caused through moisture collecting on the surface of the leaf. Another discoloration is caused through the cells of the leaf being prematurely killed, preventing the necessary chemical changes taking place. This happens when the ventilation is excessive and the temperature is increased too rapidly; the leaf in this case has a dark greenish red or blackish coloration. Sponged tobacco is of more value than green or blotched leaf, but the grower should try to eliminate all three classes of leaf.

The main object in fixing the colour is to try and prevent any further change in the coloration of the leaf after the yellowing stage is passed. The barn should be so managed that the moisture is carried off through the ventilators as fast as it is given off by the leaf. The temperature is regulated in such a fashion that the colour will be normally fixed in 15 to 18 hours. The top and bottom ventilators are slightly opened when the leaf is of the proper yellow colour, and the temperature registers 115 deg. F. When the ventilators are opened, the fire should be slightly increased to prevent the temperature of the barn falling below 115 deg. The ventilation is next slightly increased, and the temperature still maintained at 115 deg. until the tips of the leaves begin to curl upwards. The next step is to increase the temperature to 120 deg. F., and hold it there until the leaf begins to curl in towards the midrib. The leaf is now drying, and the temperature is further increased to 125 deg. F., this temperature being maintained until the web of the leaf is about dry.

Drying the Leaf.—To complete the curing it is necessary completely to dry the leaf, and this is accomplished by raising the temperature from 125 deg. F. to 130 deg. F. in two hours'

PROVIDING AVAILABLE NITROGEN.

In order that crops may make satisfactory growth an ample supply of available plant-food material must be present in the soil. The supply of available nitrogen can be affected greatly by the system of soil management used. Rapidly decaying organic material in the soil releases soluble nitrogen in the form of nitrates, which are readily assimilated by the crop plants. The addition of manures, crop residues, or green manure in this way adds much to the supply of available nitrogen.

Weeds growing on the land take out nitrates and thus deprive the crop of this valuable plant food. Weeds may also absorb the soluble nitrogen to such an extent that the next crop will be greatly delayed in starting. For this reason fallow land or land to be seeded soon to a crop should be kept free of weeds. The weeds also reduce the moisture as well as the nitrate content of the soil.

Much of the advantage gained by early ploughing and early preparation of the ground for wheat is due to the early destruction of weeds. Thus they do not rob the soil of moisture or plant-food materials that are made available during this period of soil preparation by soil micro-organisms.

Proper attention in providing an ample supply of available nitrogen not only aids in giving higher yields of crops, but helps in producing crops of better quality. The protein content of wheat, for example, depends largely upon the supply of available nitrogen. It may usually be increased by increasing the supply of available nitrogen in the soil.—(Kansas Agricultural Experiment Station: Bulletin No. 260.)

LEGUMES.

The growing of legume crops that are able to take free nitrogen from the air by means of bacteria living in the nodules on the roots affords the most natural and practical

method of maintaining the nitrogen supply of the soil. Some of the nitrogen collected by legume plants is stored in the nodules of the roots and in the roots themselves, while a large part of it is used in building up the protein material in the leaves, stems and seeds. In fact the top part of the plant contains from two to six times as much nitrogen as the roots, the amount varying greatly with the stage of development of the plant and with different legumes.

It is evident, therefore, that if the top part of the plant is removed from the soil much nitrogen and organic matter are removed also. On the other hand, if the crop is fed to livestock a large part of the nitrogen and much of the organic matter will be returned to the soil in the manure. If the greatest benefit is to be obtained from growing legumes use must be made not only of the nitrogen and organic matter in the roots of the plants, but also of the fertility contained in the tops of the plants, in so far as possible, by returning to the soil this part of the plant in the form of green manures or the manure from livestock.—(Kansas Agricultural Experiment Station: Bulletin No. 260.)

HANDBOOK OF TOBACCO DISEASES.

Attention of readers is drawn to the fact that the Department of Agriculture has found it most inconvenient, with the present shortage of staff, to handle the local sales of this book. Arrangements have therefore been made with the Rhodesian Printing and Publishing Company for distribution by them throughout Southern Rhodesia. The book may be obtained from the Herald Store, Salisbury, price 4s., or, postage paid, 4s. 4d.

SOUTHERN RHODESIA.

LOCUST INVASION, 1933.

MONTHLY REPORT NO. 2, JANUARY, 1933.

1. **Nomadacris septemfasciata.**—Further reports of egg-laying by this species have come from the following districts during the month, viz.:—Wankie, Bubi, Gwelo, Insiza, Selukwe, Chilimanzi, Hartley, Lomagundi, Mazoe, Melsetter, Bikita, and Ndanga. Hoppers have appeared during the period under review in 19 districts, the free districts being in the southern portion of the colony.

The large flying swarms have been gradually dispersing or disappearing and egg-laying appeared to be on the wane towards the end of the month.

2. **Locusta migratoria migratorioides.**—Emergence of hoppers of the Tropical Migratory Locust has occurred in Darwin, Mazoe, and Mrewa Districts during the month, and more eggs are stated to have been laid in Mrewa.

3. **Parasites.**—The parasite that appears at present to be the most important is *Stomatorrhina lunata*, F., attacking the eggs of the Red Locusts in the Lomagundi and Mazoe Districts. It is believed to be present elsewhere. It was first found, during the present invasion, early in January. Parasitism of over 90% has been recorded from one farm and is believed to exist in others. Low percentages have also been found. Other enemies of Red Locust eggs are mites and Coleopterous larvae.

Four Dipterous species have been reared from Red Locusts received dead in the laboratory, but it has not been established that any of these is parasitic. A species of red mite has been taken from Red adults in the field. A large percentage of adult Red Locusts from an egg-laying swarm (left behind by a large swarm) was found to be infested with round-worms.

4. Destruction of Hoppers. — Hatchings of the Migratory Locust have been dealt with in the Darwin District and the situation in the Zambesi Valley near the Portuguese Border in this District is well in hand. Many swarms of both species have been destroyed in the Mazoe District and hatching continues. In the Zambesi Valley the destruction of very heavy hatchings of the Red Locust is proceeding. In the Lomagundi district the hatchings have been exceptionally heavy and widespread and a considerable staff of Europeans and natives is being employed in the work of destruction on Crown Lands and in Native Reserves. Hatchings in the districts of Wankie, Bubi, Nyamandhlovu, and Bulalima-Mangwe are reported to be heavy.

Operations against hoppers of one or both species are being carried out in twenty-one districts. Further hatchings are expected and prepared for in various parts of the colony.

The farmers generally are destroying hoppers on their farms in a satisfactory manner and are co-operating well with the local officials.

It is to be realized that complete extermination of hoppers in the more remote portions of the Colony is an impossibility and that the expense incurred would not be justified in view of the heavy infestations in neighbouring territories which are not apparently being attacked.

RUPERT W. JACK,
Chief Entomologist.

FARMING CALENDAR.

March.

BEE-KEEPING.

As the latter end of this month should herald the approach of the second and last real honey flow of the season, see that enough extra supers are ready for placing on hives as required, watching also that the fully drawn out combs of shallow frames that are on hand to fill them with are kept free from the wax moth; further, examine all supers that are already on the hives for this serious defect, though strong colonies will as a rule keep the combs free from this pest. March being usually a hot month, look well to the entrance; enlarge when and where necessary, and have ventilating lids on the tops of each hive. Extra ventilation can be provided for when required by placing small metal or wooden wedges underneath the top super, but not to be open enough to let out or in a single bee. Where quilts are noticed to have been eaten or more or less destroyed during the summer months, now is the time to make fresh ones so as to be ready for the closing down and the making snug of each hive when winter approaches; old flour bags or old deck chair canvas make capital quilts. Bees during this month will consume a quantity of water; see that some is always kept in the apiary in floating cork chips. This will save much labour and flight for them, as well as prolong their period of work and usefulness. As stated in last month's notes, flying swarms may be expected now any day, so prepare for their capture if required by having all details and items ready for immediate use. It is as well, however, at this date of the season to do without such swarms, unless the owner is prepared to feed them well during the winter months. March or April swarms, unless they are hived under conditions of providing all the frames, of fully drawn out old combs, do not as a rule have either the time or materials to provide for a strong colony before the winter sets in, and must perforce remain a weak one during that period. The axiom of every bee-keeper should be to let his colonies go into winter quarters brimming over with bees, not only to provide against the mortality that is bound to occur then, but to have a full hive to start the next season with.

CITRUS FRUITS.

Two thorough sprayings about this season, when the rains are usually practically over, at an interval of about two weeks, will often obviate the necessity for further work against scale insects until the beginning of the next wet season. If not already done, orchards should be ploughed and cross-ploughed and worked up into a really good surface, so that the cultivators can be kept going, say, every two weeks until it is necessary to irrigate, after which cultivation should be continued. If March prove a dry month, orange trees holding up a crop of fruit will probably require irrigation, but under normal weather conditions it should not be necessary. The same remarks apply as last month with regard to fruit moths. About the end of this month fall budding can be taken in hand, that is the insertion of buds that are intended to remain dormant until spring. This applies to higher altitudes, but in low country, where the growing season is extended, dormant budding should not be done until latter end of April.

CROPS.

Watch oats for rust, and, if badly infested, cut crop for hay as soon as weather permits. Ridge late potatoes, and if weather is dry prevent

ridges from cracking, to check tuber moth infestation. Finish ploughing under all green manure crops while the ground is still moist enough to promote rapid decomposition. Late in the month begin to cut silage crops and ensile. Cut out barren maize plants and feed to stock or ensile. Cut Sudan grass for hay to permit of final late growth for autumn grazing. Reap any crops that are ready, and plough the stubbles **at once.** Lift ground nuts that are sufficiently matured. Watch for ground nuts making second growth; reap, and when sufficiently dry, place in cocks with nuts inwards and cover the top securely. Sow onion seed beds for winter crop. Watch the weather for hay-making and take advantage of fine spells. Towards the end of the month hay-making should normally be in full swing. Continue to plough all lands in succession immediately the crops are reaped from them. Vleis and irrigable lands should now be ready, or in process of being prepared, for winter crops. Early sowings of Algerian oats, barley or rye for green forage can be made. Allow any potatoes lifted to dry before storing them, but do not leave too long in the sun. Destroy witch weed and other noxious weeds. Continue to make all the kraal manure possible by throwing grass and litter into kraals, yards, etc. Begin to select in the field maize plants for seed purposes, and mark them with slips of coloured cloth. Press on with the breaking up of any virgin land which may have been stumped or cleared earlier in the year. Place orders for grain bags without delay. Early in the month silage pits should be cleaned out or, where necessary, new pits dug.

ENTOMOLOGICAL.

Maize.—The stalk borers of the second brood may now be found in the stalks, but nothing can be done at this stage. Caterpillars sometimes attack the crop as a sequel to cultivation after grass weeds have made too much growth. The caterpillars attack the crop on account of their more natural food being suddenly destroyed. Prevention and not cure is indicated.

Tobacco.—The crop will by this time mostly have outgrown insect injury, but leaf miners and budworms may be in evidence. The latter are usually destroyed by hand when topping. Any plants affected with stem borer should be removed and destroyed.

Potato.—If ladybird beetles or caterpillars are injurious, spray with arsenate of lead (powder) 1 lb. to 30 gallons of water. Careful hilling should be attended to with the object of preventing and checking tuber moth attack.

Vegetable Garden.—If sawfly attacks plants of the cabbage family dust with Paris green 1 lb., fine sifted slaked lime 20 lbs. Against cabbage louse (aphis) wash plants frequently with a strong spray of water. Destroy blister beetles by hand. Plants of the melon family may be baited regularly with arsenate of lead (powder) 1½ ozs., treacle ½ gallon (or cheapest sugar 2½ lbs.), water 4 gallons, to keep down fruit flies. For leaf-eating caterpillars and beetles, etc., spray with arsenate of lead (powder) 1 lb. in 30 gallons of water on foliage which will retain water. Cabbages are best dusted.

Citrus Trees.—Collect and destroy infested fruit to keep down citrus codling. Fruit-piercing moths sometimes attack the fruit during the month, especially navels. They work at night and can only be dealt with at present by hand destruction. The trees should be watched for development of aphis and soft brown scale on the young growth and prompt measures taken. Resin wash at two-thirds standard strength is suitable.

Mosquitoes, House Flies, etc., may be very prevalent during March. Destroy breeding places. Poison or trap adult flies. Attend to screening of residence.

FLOWER GARDEN.

Flower seedlings for winter blooming should now be coming on, and should be planted out during showery or cloudy weather. Cuttings of

carnations may now be made, and should be taken from selected plants which have borne the choicest blooms. The cuttings should be dibbled in half paraffin tins containing three parts sand to one of loam, and kept in a moist condition in a shady position sheltered from the winds. Make main sowing of winter-flowering sweet peas in a well-prepared and rich soil.

VEGETABLE GARDEN.

The sowing calendar is the same as that recommended for last month. Plant out from seed beds cabbage and cauliflower; care should be taken during this month, as the end of the rainy season approaches, to dig with a fork all the ground in the garden. The heavy rains settle this down hard, and as soon as the dry weather begins the soil cracks and lets out all the sub-soil moisture by evaporation. As soon as the rains cease entirely it is advisable to go over the ground and fine down with a rake, leaving some three or four inches of quite fine soil to act as an earth mulch.

FORESTRY.

Cultivation where necessary should be undertaken between the rows of trees planted out in previous months. If cultivation is carried out with the hoe, care should be taken not to pile earth round the base of the stems. New ground for next season's planting should be roughly broken up with the plough. Bulk plantings may be proceeded with during the month.

GENERAL.

At this time the condition of stock on the veld is usually good. It is well, however, to look ahead and make ready for the coming winter by the provision of winter feed in such forms as veld hay, silage, baled fodder from maize, manna, oats, teff, velvet beans, and the like, and by taking steps to ensure that water will be available for the stock in winter as near their grazing ground as may be.

POULTRY.

The breeding pens should have all been mated up by now, as the first chicks should be out by the beginning of April. Much more care should be used than is usually the case when selecting birds for breeding. Only the very best, i.e., the strong, healthy, vigorous ones from the best layers, should be chosen. A pamphlet on "Selection and Mating for Improvement" can be obtained on application to the Editor or the Poultry Experts. This deals fully with the subject. Always keep an eye on the male bird; many are apt to get thin and run down in health, due to their allowing their mates to eat all the food. Such birds are better breeders than those that chase their mates away from the food. Every male that is being bred from should be given a good meal by himself each day, to ensure health and vigour. The incubator should be thoroughly overhauled, cleaned and disinfected before the eggs are put in.

STOCK.

Cattle.—Arrangements for winter feed should be pushed on. For a well balanced winter ration, in addition to good quality veld hay, a succulent feed such as maize silage, majordas or pumpkins and a legume hay such as velvet beans, cowpeas or dolichos beans are essential. The milk supply will begin to decrease. In the case of cows rearing calves it is often good policy in this month to cease milking the cows and to allow the calves to get all the milk from now on. Slightly increase the amount of grain to the dairy cows and increase the proportion of protein concentrate in the dairy cow mixture to make good the usual loss of feeding value in the grass. Bullocks fattening on grass will do better for a daily ration of some succulent feed such as green mealies or sweet potato tops.

Sheep.—Grass seed may be very troublesome. Keep the sheep on short grazing, or, alternatively, put them on to grazing which has been mown. Crutch the ewes due to lamb.

DAIRYING.

This is usually the most favourable month of the year for dairy operations. Cooler nights are now in evidence, and there is usually little difficulty in maintaining a low temperature in the dairy and cheese-room. If elementary precautions are taken, all cream should be first grade, and first-class cheese should be made, as a gassy condition of the milk is rare. Dairy cows, unless they are very high producers, can go without extra rations, because the grass is now in seed and grazing is ample. The cheese storeroom is generally full of cheese, and care should be taken to turn the cheese regularly. The windows and doors should be opened at night and closed in the daytime. A little mould on the cheese will not affect its quality, but if the mould is excessive the cheese should be rubbed daily.

Calves which are under four months old should be kept in and allowed to nibble at well-got hay; at the same time a little dry mealie meal and monkey nut cake will do them good and teach them to eat concentrates. An ample supply of clean water should be provided in the calf run.

TOBACCO.

All late plants should be topped low to hasten maturity. The bales of cured leaf should be examined to ascertain whether or not the tobacco has been baled in proper condition. Seed heads should receive continued care. Land ploughed during February should be disced and rolled to assist the decomposition of organic matter. Tobacco fields already cleared of plants should be immediately ploughed. Tobacco bulks should be examined and turned, if necessary.

WEATHER.

Rains may be looked for in considerable quantity, though less than in previous months, 5 inches in Mashonaland and 3 inches in Matabeleland being normal, with as usual more on the eastern frontier. No useful rain need be reckoned upon after the end of this month, except on the eastern border, but the rainy season tapers off in an irregular and often erratic manner and without certainty.

April.

BEE-KEEPING

The notes given for last month will in the main apply to April also, according as to how the season develops. New swarms are not recommended to be hived during this month unless they are supplied in the first instance with fully drawn out frames and the owner is prepared to feed them now and again during the winter. As April should be a very active month for the bees, watch carefully the progress of the crates in which surplus honey is being stored, and have plenty of frames—fully drawn out if possible—ready fixed with foundation so as to place on extra crates as occasion may require; these should be placed under the full or filling one and not on the top, as might appear the case. For the benefit of those who would like a little honeycomb, it might be stated that if two or three shallow frames are fitted with four empty comb sections, and placed in the crate, the bees will take to this plan and so provide both comb and honey for extraction in the one crate. In this African climate full crates can be left on the hive with safety until ready for extraction, but if any are taken off they must be watched now and again until they are extracted for damages from the wax moth, which in a day or so can ruin both the comb and honey.

CITRUS FRUITS.

During the first half of this month, autumn budding can still be performed if the sap is still up and the bark of the stock slips freely. Unprofitable and off type trees that have been headed back for top working and which have been carefully thinned out may have the shoots on which February-March buds have failed re-budded to profitable varieties. If the March rains have been sufficient and ploughing and cultivation have been completed, continue cultivation to retain soil moisture and destroy winter weeds. If a dry March has been experienced and cultivation has been badly performed, irrigation should be commenced or continued to keep the trees and fruit in good order. If not already applied to the unthrifty trees which are late with their autumn flush, soluble fertilisers containing nitrogen and phosphoric oxide can be applied with advantage to these trees. The fertiliser should be worked into the soil with a cultivator and followed up with an irrigation. Exporters should have everything in readiness for packing the early fruit, which should be fit to market about the end of the month. Scale infested fruit will be unfit for export unless treated at once. See entomological notes for treatment.

CROPS.

If sufficiently mature, begin cutting and stooking early maize over a small acreage and plough up the ground whilst still damp between the rows of stooks. If ripe, reap and husk early planted maize, and keep in a separate dump. Continue to make field selections of the best maize plants, and mark those required for seed with strips of coloured cloth. Lift any ground nuts and potatoes showing signs of making second growth. Make silage; cut maize for this when the ears are in the "dough" stage. Pick up and stook maize plants blown over to protect the ears from white ants. Feed sweet potato vines to stock, reserving any new growth of vines for feeding as grazing in May. Plough in any green manure crops not already turned under. Plough fallowed land. Keep potatoes reserved for seed on racks in a cool place protected from frost, but well ventilated. Transplant onions from seed-beds to irrigated or naturally moist lands; irrigate about once a week, but do not apply too much water. Pick over potatoes which may be lifted, and remove the bad and diseased ones. Winter cereal crops for grain can be sown towards the end of the month. Cart manure to the lands. Remember that good and deep ploughing to a depth of at least 7 to 8 inches is essential, and the basis of all successful arable farming. If the lands are not already ploughed so deep, increase the depth of ploughing about an inch a year until this depth, or even more, is reached. On lands which have been ploughed for a number of years at the same depth, use a grubber to stir up the sub-soil without lifting it to the surface. Too much attention cannot be paid to good tillage. It is usually good practice to follow the plough at once with a harrow or other suitable implement to break down the clods before they bake hard. Continue breaking up new lands; the earlier this is done the more complete is the decomposition of the vegetable matter in the soil. When making hay of coarse legumes such as velvet and dolichos beans and cowpeas, be sure that the vines are dry before stacking. Handle the hay as little as possible to avoid loss of leaf. Thought should be given to laying in supplies of thatching grass for thatching and repairing roofs. The veld may be beginning to dry off. Consideration may be given to mowing or otherwise preparing fire lines as a preventive against veld fires.

DECIDUOUS FRUITS.

If not already done, orchards should be ploughed, harrowed and well cultivated to retain the soil moisture for spring blossoming and growth. Varieties such as the Chinese peaches, etc., may be pruned after the leaves have dropped.

Order all trees for winter planting during June-July. August planting is unsafe for many early growing varieties of fruits.

All late apples should be harvested and stored or marketed.

ENTOMOLOGICAL.

Maize.—Although certain pests, such as earworm and stalk borer, may be in evidence, there are practically no operations against insect pests that can be carried out economically during this month.

Tobacco.—Any remaining plants showing stem borer attack should be removed and burnt. Watch should be kept for the emergence of the adult wireworm beetles. These should be poisoned with a bait consisting of maize bran moistened with a solution of 1 lb. arsenite of soda in 20-30 gallons of water. The bait should be rolled into a small ball and scattered on the lands, one ball to each 10 square yards. The bait should be covered with a few leaves and moistened as required. Chopped green stuff such as Napier fodder may also be used as a carrier for the poison, in which case molasses should be added at the rate of 1½ gallons to 10 gallons of the arsenite solution, or cheapest sugar at the rate of 8 lbs. per 10 gallons. The bait is best laid in the evening.

Cotton.—Damage to bolls from bollworms may be noticed by the flaring of the bracts and the dropping of the bolls. All dropped bolls should be collected and destroyed. Guinea-fowl, turkeys, etc., may be encouraged to destroy stainers, etc. Stainers should be trapped in traps of cotton seed or trash and destroyed.

Citrus.—Collect and destroy infested fruit to keep down citrus codling moth. Red scale should be destroyed by fumigation with hydrocyanic acid gas or with resin wash. Soft brown scale may be controlled with resin wash. It will be controlled by fumigation with hydrocyanic acid gas where this is practised against other scale insects. Aphis may develop on young growth and may be kept down by spraying with nicotine or home-made tobacco wash.

Vegetable Garden.—Plants of the cabbage variety are liable to suffer severely from cabbage louse and Bagrada bug. The former can be kept largely suppressed by frequent washings with a strong spray of cold water or with a nicotine spray. Bagrada bug is more difficult to control. Crude carbolic emulsion, 1 part in 15 parts of water, or resin wash gives partial control. The spray must hit the insect to kill. Do not re-plant a cruciferous crop (cabbage family) on the same plot. Thoroughly clean and work the soil.

Potatoes.—Potatoes should be cultivated systematically and hilled up to keep the tuber moth from the tubers.

FLOWER GARDEN.

The garden can generally be depended upon to make a good show in the autumn and early winter, provided that the plants have been previously kept in a healthy condition by watering, mulching and feeding. Snap dragons and other seedlings, also cuttings, may now be planted out into their permanent positions. Sowing may be made of hardy annuals, such as hollyhocks, larkspur, clarkia, pansy, petunia, sweet peas, gaillardia and candytuft. Bulbs of spring flowering plants may be taken up, divided and replanted.

VEGETABLE GARDEN.

Sow at once all that is required to fill up the vegetable garden before the soil has parted with all moisture. Seeds sown now will germinate freely, and plants will establish themselves more quickly than during the colder weather, which can soon be expected. A start should now be made at cleaning asparagus beds. This is a most popular vegetable, and yet one rarely sees it cultivated in the ordinary Rhodesian garden. It is supposed to be difficult to grow, but this supposition is not borne out, as, once established, a bed of asparagus is one of the most easily managed vegetables in the whole garden. Depth of good soil and plenty of manure are all that this plant requires. Rhubarb roots may be taken up, divided and replanted this month. Plant out from seed beds cabbage and onion plants into their permanent quarters. Sow a full crop of peas, broad beans, turnips, onions, lettuce and radish.

FORESTRY.

Cultivate the soil in the young plantations either by means of machines or hand labour. The cultivation will conserve moisture. Hoed out weed growth should be applied as a mulch round the base of each young tree. Be careful not to pile earth round the stems of the young trees. Covering the stems with earth even for an inch or two interferes with sap circulation and invites attacks by termites.

Prune the young trees to single stems. Any exceptionally strong undesirable branch growth may be checked by breaking off the leading shoot, but ordinary branch growth should not be touched.

POULTRY.

The first chicks should now be out, and these, having been hatched, must be well looked after. No food should be given for the first 36 to 48 hours. Leave them to sleep as much as possible. See that they have plenty of fresh warm air, but are not exposed to draughts. After 48 hours give some small grit and charcoal to purify the intestinal tract and aid digestion. A pamphlet dealing very fully with incubation and rearing of chickens can be obtained gratis on application to the Poultry Experts, Department of Agriculture.

One comes across many cases of wrong treatment of chickens in this country, the chief being uncleanliness, over-crowding, giving food too early and dirty drinking water. Two most important foods are animal protein, especially in the form of thick separated or whole milk and green food, especially onions or eschalots or their green tops. The loss in the rearing of chicks is very great; this should not be so if good breeding stock is used, the eggs from these are carefully handled and incubated and the chicks reared with care and common sense.

Any turkey chicks hatched at this time of the year should be well looked after. They should be kept warm, dry, free from insects, fed on dry food only, given plenty of thick separated milk, onions or onion tops, dry mash and grain. A pamphlet on turkeys and turkey rearing is obtainable gratis from the Poultry Experts.

Ducks should do well during the month, the weather being as a rule cool, moist and bracing; but the houses in which they sleep must not be damp. Duck breeders should always be on the "qui vive" for a round worm called "Trichosoma contortum," which is often fatal to ducks. It is found in the œsophagus, and causes arrest of growth, emaciation and weakness and sometimes epileptiform attacks. A swelling will be noticed at the lower part of the neck, which rapidly increases in size, and death occurs in one to three days. Onions, or preferably garlic, mixed with the food is a good preventive and cure. Another good remedy is essence of turpentine mixed with twice its quantity of olive oil and one or two tablespoonfuls given for a dose.

STOCK.

Cattle.—Where winter conditions are good, early spring calves may be weaned now, but a common practice is to allow them to run with their dams until the early rains. Where supplementary feed is available, April to June are probably the best months of the year for cows to calve in. These months also suit the dairy farmer. Provide succulent feed for the dairy herd. Dry off cows which will not pay for a grain ration during the winter. Bullocks for winter fattening should be selected now.

Sheep.—The ewes should be kept in good shape for lambing. Put the big udder ewes on the green feed.

DAIRYING.

At this season of the year the milking kraal is generally far from clean owing to the excessive amount of mud or dust which has accumulated during the latter part of the rainy season, and in consequence

farmers invariably have trouble in producng first-grade cream. Every endeavour should be made to erect a small milking shed in which four or five cows or more can be milked at a time, and every effort should be made to keep the cows clean. The udders should be wiped before milking with a clean, damp cloth, and the farmer should see that the natives' hands are washed with soap and clean water before and after each milking.

If butter is made, the cream and washing water should be put out overnight, and if the cream is churned early the following morning, very little difficulty should be experienced in obtaining a good grain and a firm body in the butter.

From this time of the year onwards, cheese making operations are usually most successful. The evening's milk should not be kept in the dairy, but should be placed outside, preferably in a bath, and covered over with butter muslin, cheese cloth or mosquito gauze netting. Care should always be exercised, however, in using evening's milk. Morning's milk plus a starter usually gives the best quality, and if a starter is used, care should be taken that it shows no signs of gasiness or off flavours.

The season of abundant green pasture is over, and the natural grazing, unless supplemented by some green food or succulent roughage, is not sufficient to maintain a full flow of milk. The most economical supplement to veld grazing at this time is maize silage, and this should be fed in liberal quantities to all milking cows and growing stock. A few pounds of concentrates in addition would also be of great benefit to the milking cows, which should not be compelled to subsist entirely on veld hay and silage.

TOBACCO.

The grading of the brighter grades should be proceeded with as soon as convenient. All leaf which has cured green should be bulked separately and be regularly examined to avoid serious damage through overheating. Tobacco seed heads, when mature, should be removed from the plants and stored where no damage will occur through activities by rats and mice. Care should be taken to store these seed heads with the pods uppermost, as otherwise much seed may be lost. Clear and plough the land soon after the crop has been harvested. Burn old stalks as a control measure against possible carry over of disease.

SOUTHERN RHODESIA WEATHER BUREAU.

JANUARY, 1933.

Pressure.—Mean monthly pressure was about normal in the south but below normal to the north and east.

The equatorial low extended to the south-west on the 1st and swung to the south-east coast on the 2nd and 3rd.

It appeared over the Free State on the 5th and a trough swung through Southern Rhodesia on the 7th and 8th; pressure remained low over Madagascar for some days.

On the 8th the equatorial low extended to the west coast and deepened gradually; on the 11th it was well inland and moved to the south-east coast on the 12th. On the 13th it covered the whole Union and then withdrew towards the west coast. It moved again on the 16th and on the 18th was on the south-east coast with a well-marked squall on the 19th and 20th; it deepened over the Union and on the 21st became central in Southern Rhodesia, the pressure at Salisbury falling to 843.3 mbs. at 15.00 on that date; the low remained across the northern part of the country until the 25th, when it was filling up and the centre appeared to have become established over Madagascar. The southern portion of the country was affected by very strong south-east winds from the 22nd to the 25th. Record low pressures occurred at all stations. Minor movements occurred on the 26th to 28th and 30th to 31st.

Highs moved round the coast on the 3rd to 5th and 7th to 8th and no further activity appeared until the 21st, when a high appeared on the west coast and moved round to the east on the 24th. It was reinforced on the 25th by a second high and a third moved in on the 30th.

Temperature.—Minimum temperatures were about normal but the mean maximum for all stations was very low.

Rainfall.—The seasonal rainfall as calculated from all stations is as follows:—

October 0.34, November 1.97, December 8.45. Total to end of December 10.76, or 0.90 above normal. The total for January from telegraphic reports is 9.76 inches, or about 2.8 inches above normal.

A schedule of daily rainfall and observations at a number of stations is appended.

JANUARY, 1933.

Station.	Pressure Millibars, 8.30 a.m.		Temperature in Stevenson Screen ° F.								Rel. Hum.	Dew Point	Cloud Amt.	Precipitation.			Alti-tude (Feet).
			Absolute.		Mean.												
	Mean.	Normal.	Max.	Min.	Max.	Min.	½ Max. Min.	Nor-mal.	Dry Bulb.	Wet Bulb.	%	F.	0-10	Ins.	Nor-mal.	No. of Days.	
Bulawayo ...	866.5	866.5	86	54	77.2	60 4	68.8	71.4	66.8	62.9	81	60	8.1	4.64	5.76	18	4,436
Gwelo	860.2	...	83	52	75.9	60.1	68.0	71.4	66.0	63.2	86	62	8.4	9.36	5.98	20	4,638
Riverbank ...	...	...	89	52	79.9	62.3	71.1	74.4	69.7	64.7	76	62	...	6.72	6.34	16	4,100
Essexvale ...	...	...	91	52	79.9	62.8	71.4	73.9	68.0	64.8	84	63	...	5.92	6 40	16	3,828
Gwanda ...	903.2	...	92	55	79.2	62.9	71.1	...	70.3	65.9	79	64	6.8	8.86	5.75	14	3,235
Mazunga ...	945.6	945.6	98	58	85.7	65.9	75.8	78.8	73.5	65.0	63	60	7.8	9.86	3.51	10	1,970
Between Rivers	...	...	86	57	80·4	62.3	71.4	...	69.7	66.1	83	64	6.7	10.85	7.62	23	3,970
Enkeldoorn ...	854.9	...	83	52	75.3	59.9	67.6	70.2	66.9	63.6	83	61	8.1	23.42	7.14	22	4,800
Gatooma ...	...	...	86	52	80.2	61.6	70.9	74.3	68.8	65.9	86	65	7.6	10.11	7.62	23	3,850
Miami	875.9	...	84	57	75.6	63.0	69.3	...	67.4	64.7	87	63	8.6	7.03	9.10	22	4,088
Salisbury ...	852.5	853.2	82	54	76.2	60 2	68.2	69.3	67.0	63.2	81	61	8.5	10.18	7.37	20	4,865
Sinoia ...	885.3	...	86	59	78.9	63.7	71.3	...	69.7	66.2	82	64	6.9	13.00	7.63	23	3,804
Sipolilo... ...	...	...	82	58	76.0	62.9	69.4	...	68.4	65.0	83	63	6.5	7.51	8.99	17	3,900
Rus·pi ...	...	...	84	50	77.5	61.0	69.2	...	68.2	64.2	81	62	7.0	7.75	8.30	18	...
Bindura ...	...	...	84	60	77.5	64.1	70.8	...	68.4	66.0	83	63	7.9	9.85	7.48	23	...
Angus Ranch ...	...	...	92	61	82.9	68.0	75.5	77.2	73.6	69.7	83	68	...	12.60	5.80	20	2,300
Craigendoran ...	...	...	88	53	80.3	63.6	71.9	...	72.0	67.7	80	65	...	10.79	8.06	22	3,430
New Year's Gift	...	...	86	56	79.9	63.9	71.9	...	70.6	67.2	83	65	...	10.91	8.25	21	2,700
Nyamasanga ...	...	...	80	48	73.7	58.0	65.8	...	65.5	62.2	83	60	...	14.33	...	23	5,080
Riverdene North	...	...	88	50	79.6	62.2	70.9	...	69.0	66.2	83	65	...	16.46	6.77	24	3,700
Stapleford ...	...	...	78	42	70.1	56.2	63.1	...	63.5	61 5	89	60	8.5	9.95	8.20	22	5,450
Umtali	890.1	891.3	84	53	77.8	62.7	70.3	71.9	69.2	65.8	83	64	7.9	6.61	8.35	24	3,677
Victoria ...	892.9	892.8	87	53	78.3	63.1	70.7	72.3	69.3	65.4	82	64	6.4	9.05	6.43	21	3,580
Melsetter ...	848.6	...	80	52	73.3	58.5	65.9	...	65.8	61.8	80	60	7.9	13.02	11.76	21	5,060
Mount Selinda	...	...	85	55	74.9	62.4	68.6	...	68.0	65.5	87	64	8.4	17.89	14.96	23	3,520

Rainfall, January, 1933, in Hundredths of an Inch. Telegraphic Reports.

ea	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Total.
	5	11	8	26	4	1	...	...	5	...	10	19	34	31	34	58	38	57	87	79	97	41	33	22	3	...	...	...	...	1	...	704
	6	36	61	23	16	...	...	24	1	...	64	25	28	7	10	156	29	44	81	65	61	266	94	50	32	...	...	...	2	33	...	1,214
	10	16	109	63	52	7	6	6	...	...	...	8	11	106	22	42	36	24	27	144	22	400	82	61	70	2	...	...	8	73	1	1,408
	49	123	92	67	78	29	27	23	17	...	53	2	23	47	38	64	10	18	34	26	131	144	43	9	45	1	...	...	...	3	...	1,196
	63	5	23	65	1	...	7	10	...	...	...	6	33	7	42	84	58	50	90	42	31	12	4	1	1	2	...	...	21	...	...	658
	27	61	62	63	79	21	109	49	4	12	10	23	135	25	11	139	21	1	54	47	33	113	110	76	74	...	...	...	...	...	...	1,359
	17	22	71	79	64	2	30	11	15	31	67	13	62	25	56	18	15	33	47	51	20	25	41	41	135	10	...	...	...	15	2	1,021
	7	13	35	23	63	...	44	55	16	14	23	3	35	32	35	129	36	26	80	46	30	103	20	185	73	27	...	...	...	7	6	1,166
	19	84	9	16	19	...	45	44	23	39	...	17	24	...	11	134	52	6	46	95	82	70	13	92	34	92	7	...	...	1	8	1,082
	27	37	4	17	9	...	...	7	...	...	1	...	101	...	23	46	90	30	16	160	35	123	12	3	195	115	...	...	...	...	53	1,104
1	25	39	37	42	27	4	21	20	8	10	24	14	42	18	29	90	39	35	65	67	63	93	38	41	46	22	1	...	4	8	4	976

SOUTHERN RHODESIA VETERINARY REPORT.

December, 1932.

AFRICAN COAST FEVER.

Melsetter District: No fresh outbreaks.

FOOT AND MOUTH DISEASE.

No fresh outbreaks. All cattle concentrated for inoculation in the Gwelo and Gwanda districts were returned to the areas from which they had been removed. As far as is known there is no infection at any centre in the Colony.

EPHEMERAL FEVER: THREE DAYS' SICKNESS OF CATTLE.

Prevalent throughout the Melsetter district.

ANTHRAX.

An outbreak occurred in cattle in the Victoria district. Arrangements were made for the inoculation of the herds involved.

REDWATER AND GALLSICKNESS.

Both these diseases are more prevalent than usual in various districts.

SNOTZIEKTE IN CATTLE.

An outbreak occurred on a ranch in the lower part of Matobo district and a mortality of 25 head was recorded.

CUTANEOUS MYIASIS OF CATTLE: SCREW WORM.

Prevalent in the Midlands.

IMPORTATIONS.

From the Union of South Africa: Bulls 4, Horses 1, Sheep 1,437, Goats 70, Pigs 21.

EXPORTATIONS.

Chilled Beef to England: Fore-Quarters 58, Hind-Quarters 61.

JAMES M. SINCLAIR,
Chief Veterinary Surgeon.

SALES.

AGRICULTURAL EXPERIMENT STATION, SALISBURY.

Spineless Cactus Slabs (blades) Algerian variety, per 100 slabs, 7/6 Salisbury, or 12/6 delivered free by rail to purchaser's nearest station or siding in Southern Rhodesia. For amounts of 500 slabs or more a reduction of 2/6 per 100 will be made.

Stocks are limited and delivery cannot be undertaken after 15th November.

Kudzu Vine Crowns, per 100 crowns, 15/-, Salisbury, or 25 crowns, 7/6; 50 crowns, 15/- and 100 crowns, 22/6, delivered free to purchaser's nearest station or siding in Southern Rhodesia. Delivery during September and October for irrigated land, and in January for dry land. Owing to pressure of other operations, it is not possible to deliver Kudzu crowns during November and December.

Woolley Finger Grass: 10s. per bag of roots, delivered on rail nearest station or siding; supplies limited. Available January and February.

The prices quoted above do not include charges for road motor transport. Cheques should be made payable to the Department of Agriculture, and preliminary enquiries and subsequent orders should be addressed to the Chief, Division of Plant Industry, Department of Agriculture, Salisbury.

DEPARTMENTAL BULLETINS.

The following Bulletins, consisting of reprints of articles which have appeared in this Journal, are available for distribution at 3d. per copy. Application should be made to the Editor, Department of Agriculture, Salisbury, and remittances must accompany orders.

AGRICULTURE AND CROPS.

No. 225. Napier Fodder or Elephant Grass, by J. A. T. Walters, B.A.

No. 374. Fibre Crops—Deccan Hemp (Hibiscus Cannabinus) and Sunn Hemp (Crotolaria Juncea), by J. A. T. Walters, B.A.

No. 429. Propagation of Kudzu Vine, by H. C. Arnold.

No. 442. Swamp or Irrigation Rice, by K. V. Yoshi, Bombay.

No. 510. Check-row Planting of Maize, by H. G. Mundy, F.L.S.

No. 545. Artificial or Synthetic Farmyard Manure, by H. G. Mundy, Dip.Agric., F.L.S.

No. 550. Onion Growing under Irrigation, by C. Mainwaring.

No. 561. Wheat Growing in Rhodesia, by C. Mainwaring.

No. 568. The Treatment of Arable Land, by G. N. Blackshaw, O.B.E, B.Sc., F.I.C.

No. 598. Drought-resistant and Early-maturing Crops for Areas of Late Rainfall, by C. Mainwaring.

No. 630. The Storage of Seed Potatoes, by H. C. Arnold.

No. 634. Barley, by P. V. Samuels.

No. 643. Noxious Weeds in Southern Rhodesia, by F. Eyles, Botanist.

No. 650. Coffee Culture in Southern Rhodesia, by G. W. Marshall, Horticulturist.

No. 651. Two Important Leguminous Crops: The Velvet Bean and Dolichos Bean, by C. Mainwaring, Agriculturist.

No. 657. Hay-making in Southern Rhodesia, by C. Mainwaring, Agriculturist.

No. 663. The Use of Fertilisers and Manures in Southern Rhodesia, by A. D. Husband, A.I.C., Chief Chemist.

No. 672. Hay-making in Rhodesia, by H. G. Mundy, Dip.Agric., F.L.S.

No. 674. Top Dressing of Maize against Stalk Borer, by H. C. Arnold.

No. 681. The Sunflower (Helianthus Annuus) (Revised), by S. D. Timson, M.C., Dip.Agric.

No. 694. The Edible Canna (Canna Edulis), by D. E. McLoughlin.

No. 695. The Castor Oil Plant (Ricinus spp.), by S. D. Timson, M.C., Dip.Agric.

No. 697. Results of Analysis of Samples taken under the "Fertilisers, Farm Foods, Seeds and Pest Remedies Ordinance" during the year 1927-28.

No. 704. The Importance of Research on Pasture Improvement in Southern Rhodesia, by A. D. Husband, A.I.C., Chief Chemist.

No. 705. Suggested Cropping Programmes for Farms on the Sand Veld, by D. E. McLoughlin, Assistant Agriculturist.

No. 706. A Farmers' Calendar of Crop Sowings, by C. Mainwaring, Agriculturist.

No. 709. Sand Veld Farming and its Possibilities, by E. D. Alvord, M.Sc. (Agr.).

No. 710. Monthly Reminders for the Farming Year, by the Division of the Chief Agriculturist.
No. 713. Ensilage, by J. A. T. Walters, B.A., Agriculturist.
No. 727. Farmyard Manure, by A. P. Taylor, M.A., B.Sc., Agricultural Chemist.
No. 732. Two Common Diseases of Potato Tubers in Rhodesia, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A.
No. 743. Sunn Hemp, by S. D. Timson, M.C., Dip.Agric.
No. 751. The Sweet Potato, by S. D. Timson, M.C., Dip.Agric. (Wye).
No. 757. Maize on the Sand Veld: Results at the Tobacco Experiment Station, Salisbury, by C. A. Kelsey-Harvey, Manager.
No. 758. Instructions for Taking Soil Samples. Issued by the Division of Chemistry.
No. 759. Witch Weed (Striga Lutea): Methods of Control, by S. D. Timson, M.C., Dip.Agric. (Wye).
No. 762. The Value of Rock Phosphate and "Bone and Superphosphate" as Fertilisers for Maize Production, by A. D. Husband, Chief Chemist.
No. 768. The Ground Nut (Arachis hypogaea), by S. D. Timson, M.C., Dip.Agric. (Wye).
No. 775. Agricultural Costings at the Gwebi Farm, by H. G. Mundy, Dip.Agric., F.L.S., Chief Agriculturist, and J. Hick, Accountant.
No. 776. Regulations Governing the Export of Maize and Maize Meal through the Port of Beira.
No. 781. Agricultural Costings at the Gwebi Farm—Maize and Green Manuring, by H. G. Mundy, Dip.Agric., F.L.S., Chief Agriculturist, and J. Hick, Accountant.
No. 787. Agricultural Costings at the Gwebi Farm—Ground Nuts and Maize and Beans for Silage, by H. G. Mundy, Dip.Agric. (Wye), F.L.S., Chief Agriculturist.
No. 793. Agricultural Costings on the Gwebi Farm, by H. G. Mundy, Dip.Agric., Chief Agriculturist.
No. 797. Green Manuring: An Essential Practice in Rhodesian Farming, by H. G. Mundy, Dip.Agric. (Wye), F.L.S., Chief Agriculturist.
No. 802. Witch Weed, by S. D. Timson, M.C., Inter.B.Sc. (Agric.) Lond., Dip.Agric. (Wye), Assistant Agriculturist.
No. 807. Studies on the Improvement of Natural Veld Pastures: No. 2, by A. D. Husband, F.I.C., and A. P. Taylor, M.A., B.Sc., Chemistry Branch, Department of Agriculture.
No. 813. A Preliminary Note on Clovers in Southern Rhodesia, by S. D. Timson, M.C., Dip.Agric. (Wye), Assistant Agriculturist.
No. 815. New Strains of Oats for Southern Rhodesia, by H. C. Arnold, Manager, Agricultural Experiment Station, Salisbury.
No. 816. Preliminary List of the more Common Grasses of Southern Rhodesia, by Sydney M. Stent, Botanist for Pasture Research.
No. 820. The Great Economic Problem in Agriculture—No. 1, by J. R. McLoughlin, M.Sc. (Economics), Economic Adviser.
No. 822. Re-stacking of Maize rejected for Export on account of Excessive Moisture.
No. 823. The Law of Supply and Demand—No. 2, by J. R. McLoughlin, M.Sc. (Economics), Economic Adviser.
No. 826. Some Poisonous Plants of Southern Rhodesia, by Sydney M. Stent, Senior Botanist.
No. 831. Revised Notes on Cotton Growing in Southern Rhodesia, by G. S. Cameron.
No. 833. Subterreanean Clover on the Sand Veld as Feed for Poultry in the Winter, by S. D. Timson, M.C., Dip.Agric. (Wye).
No. 836. The Potato, by S. D. Timson, M.C., Dip.Agric. (Wye).
No. 837. Veld Grass Silage—A Feature in Rhodesian Pasture Management, by H. G. Mundy, Dip.Agric. (Wye), F.L.S., Chief, Division of Plant Industry.

No. 838. Witch Weed—Progress Report and a Warning, by S. D. Timson, M.C., Dip.Agric. (Wye), Assistant Agriculturist.

No. 841. Poisonous or Suspected Poisonous Plants of Southern Rhodesia: Tulp Poisoning of Cattle, by Sydney M. Stent, Senior Botanist, and D. A. Lawrence, B.V.Sc., Veterinary Research Officer.

No. 855. Pigeon-hole Method of Stacking Maize, by Division of Plant Industry.

No. 859. Twenty-one Years of Plant Introduction, by Major Mundy, Chief, Division of Plant Industry.

No. 867. Agricultural Statistics for the Season 1930-31: (a) Live Stock; (b) Crops Grown by Europeans in Southern Rhodesia, compiled by the Government Statistician.

REPORTS ON CROP EXPERIMENTS.

No. 608. Annual Report of Experiments, 1924-25, Agricultural Experiment Station, Salisbury, by H. G. Mundy, Dip.Agric., F.L.S.

No. 631. Bulawayo Experiment Station: Annual Report for Year 1925-26, by H. W. Hilliard.

No. 649. Annual Report of Experiments, 1925-26, Agricultural Experiment Station, Salisbury, by H. C. Arnold, Manager.

No. 675. Bulawayo Experiment Station—Annual Report for Year 1926-27, by D. E. McLoughlin.

No. 683. Annual Report of Experiments, 1926-27, Agricultural Experiment Station, Salisbury, by H. C. Arnold, Station Manager.

No. 688. Report, 1923-24—1926-27, Gwelo Municipal Demonstration Stations, by D. E. McLoughlin.

No. 716. Report, 1927-28, Gwelo Municipality Demonstration Stations, by S. D. Timson, M.C., Dip.Agric.

No. 745. Salisbury Agricultural Experiment Station Annual Report, 1927-28, by H. C. Arnold.

No. 773. Bulawayo Municipal Demonstration Station: Report for the Seasons 1927-28 and 1928-29, by D. E. McLoughlin, Assistant Agriculturist.

No. 789. Agricultural Experiment Station, Salisbury: Annual Report of Experiments, 1928-29, by H. C. Arnold, Manager.

No. 800. Bulawayo Municipal Experiment Station: Report for the Season 1929-30, by S. D. Timson, M.C., Dip.Agric. (Wye), Assistant Agriculturist.

No. 806. Gwebi Demonstration Farm, by the Chief Agriculturist.

No. 810. Gwelo Municipal Demonstration Station: Annual Report, 1929-30, by S. D. Timson, M.C., Inter.B.Sc. (Agric.) Lond., Dip.Agric. (Wye), Assistant Agriculturist.

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No. 851. Bulawayo Municipal Demonstration Station: Final Report, 1932, by D. E. McLaughlin, Assistant Agriculturist.

No. 864. Annual Report, 1930-31: Agricultural Experiment Station, by H. C. Arnold, Station Manager.

TOBACCO.

No. 605. Flue-curing Tobacco Barns, Bulking and Grading Sheds, by P. H. Haviland, B.Sc. (Eng.), Acting Government Irrigation Engineer.

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No. 653. The Care of Tobacco Seed Beds, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A. (Trinidad).
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No. 812. Selection of Tobacco Seed Plants, by H. F. Ellis, M.Sc., B.Sc. (Agr.), Tobacco Adviser.
No. 828. Seed-Beds, by D. D. Brown, Chief Tobacco and Cotton Expert.
No. 835. Tobacco Culture—Transplanting Operations, by D. D. Brown.
No. 839. Tobacco Experiment Station, Salisbury—Report of General Crop Experiments, by C. A. Kelsey Harvey, Manager.
No. 840. Curing Tobacco by the Leaf Method *v.* Curing on the Stalk, by W. Collingwood-Evans, B.Sc. (Agr.).
No. 846. Leaf Curl in Tobacco, by Dr. H. H. Storey.
No. 850. Pests of Stored Tobacco in Southern Rhodesia, by M. C. Mossop, M.Sc., Entomologist.

Handbook of Tobacco Diseases in Southern Rhodesia, by J. C. F. Hopkins, B.Sc., A.I.C.T.A. Price 3/6 post free from Accountant, Department of Agriculture, Salisbury.

LIVE STOCK.

No. 338. From Breeder to Butcher; Beef Experiment No 5, by E. A. Nobbs, Ph.D., B.Sc.
No. 381. From Breeder to Butcher; Cattle Feeding Experiment No. 8, by Eric A. Nobbs, Ph.D., B.Sc.
No. 421. From Breeder to Butcher; Cattle Feeding Experiment No. 9, Government Experiment Farm, Gwebi, by E. A. Nobbs, Ph.D., B.Sc., F.H.A.S.
No. 446. From Breeder to Butcher; Cattle Feeding Experiment No. 11, Government Experiment Farm, Gwebi, by Eric A. Nobbs, Ph.D., B.Sc., F.H.A.S.
No. 468. From Breeder to Butcher; Cattle Feeding Experiment No. 13, by Eric A. Nobbs, Ph.D., B.Sc.
No. 483. From Breeder to Butcher; Cattle Feeding Experiments Nos. 14 and 15, Government Experiment Farm, Gwebi, by Eric A. Nobbs, Ph.D., B.Sc.
No. 624. The Construction of Dipping Tanks for Cattle (Revised).

No. 701. Feeding Bullocks at Gwebi, by S. D. Timson, M.C., Dip.Agric.
No. 719. Hand-rearing of Calves (Revised), by T. Hamilton, M.A., N.D.A., N.D.D., Dairy Expert.
No. 720. Fattening for Beef at the Gwebi Farm, by H. G. Mundy, Chief Agriculturist, and T. J. Needham, Accountant, Agricultural and Veterinary Departments.
No. 737. Fur and Wool-producing Rabbits, by Captain Edgar S. Everett, Hovere Farm, Banket.
No. 749. Dehorn your Commercial Cattle, by W. Fleming, Stock Adviser.
No. 755. Iodine in Animal Nutrition, by J. Park Hamilton, District Veterinary Surgeon, Gwelo.
No. 801. Sheep Farming in the Melsetter District, by J. C. Kruger, Part-time Sheep Adviser in the Melsetter District.
No. 845. The Raising of Bacon Pigs, by Dr. A. E. Romyn, Senior Animal Husbandry Officer; C. A. Murray, Lecturer in Animal Husbandry, Matopos School of Agriculture, and D. A. Lawrence, Veterinary Research Officer.
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DAIRYING.

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No. 530. The Dairy Industry: Causes of Variation in Cream Tests, by T. Hamilton, M.A., N.D.A., N.D.D.
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No. 785. Bacon Curing on the Farm, by T. Hamilton, M.A., N.D.A., N.D.D., Dairy Expert.
No. 792. The Feeding of Dairy Stock in Southern Rhodesia, by T. Hamilton, M.A., N.D.A., N.D.D., and J. R. Corry, B.Sc. (Agr.), Dairy Experts.
No. 799. The Objects of Ripening Cream for Butter-Making, and a few Hints on Cream Production, by F. Lammas, Dairy Officer.
No. 818. Farm Butter-making—Issued by the Dairy Branch.
No. 844. Southern Rhodesia Milk Recording Scheme.
No. 862. Cream Cheese, by F. A. Lammas, Dairy Officer.
Points to be observed in Cream Production.

VETERINARY.

No. 191. Scab or Scabies in Sheep and Goats, by Rowland Williams, M.R.C.V.S.
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No. 642. The Laboratory Diagnosis of Animal Diseases, by Ll. E. W. Bevan, M.R.C.V.S.

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IRRIGATION.

No. 384. The Application of Water in Irrigation, by A. C. Jennings, Assoc.M.Inst.C.E., A.M.I.E.E.

No. 412. Water Power Resources of Southern Rhodesia, by C. L. Robertson, B.Sc., A.M.I.C.E.

No. 529. The Umtali River Irrigation Scheme, by C. P. Robinson, B.Sc.

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FORESTRY.

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No. 575. Tending of Eucalyptus Plantations, by A. S. Thornewill, B.A.

No. 744. Farm Forest Practice in Southern Rhodesia; Part IV. Tending and Care of Young Plantations. Issued by the Forest Service.

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No. 874. Tree Planting, by the Division of Forestry.

Price List of Forest Tree Transplants, Ornamental Trees and Shrubs, Hedge Plants, Creepers and Seeds.

HORTICULTURE.

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No. 669. Citrus Fruit Growing in Rhodesia, by G. W. Marshall, Horticulturist.

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ENTOMOLOGY AND PLANT PATHOLOGY.

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No. 747. Mycological Notes: (1) Seed Treatment for Maize against Diplodia; (2) Seed Treatment for Tobacco against Bacterial Diseases. Issued by authority of the Minister of Agriculture and Lands.

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The following pamphlets can be obtained from the Poultry Expert upon application :—

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Cold Weather: Treatment of Fowls in, by A. Little, Poultry Expert.
Tuberculosis, by A. Little, Poultry Expert.
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The Close of the Hatching Season and After, by H. G. Wheeldon, Poultry Expert.

METEOROLOGICAL.

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No. 436. The Possibility of Seasonal Forecasting and Prospects for Rainfall Season 1922-23, by C. L. Robertson, B.Sc., A.M.I.C.E.
No. 524. The Use of an Aneroid Barometer, by C. L. Robertson, B.Sc., A.M.I.C.E.
No. 532. The Short Period Forecast and Daily Weather Report, by C. L. Robertson, B.Sc., A.M.I.C.E.
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No. 712. The Time, and How to Find it, by N. P. Sellick, M.C., B.Sc. (Eng.).
No. 832. The Weather Map and the Short Period Weather Forecast, issued by the Meteorological Office.

MISCELLANEOUS.

No. 248. A Preservative for Samples of Arsenical Dips for Analysis, by A. G. Holborow, F.I.C.
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No. 733. Jam-making, by Miss D. Bosman, Home Economics Officer, Division of Agricultural Education and Extension, in "Farming in South Africa."
No. 849. The Preservation of Farm Beacons, by L. M. McBean, Acting Surveyor General.
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How to Make Use of the Fencing Law.
Twelve Simple Rules for the Avoidance of Malaria and Blackwater.
Summary of the Game Laws of Southern Rhodesia

THE RHODESIA

Agricultural Journal.

Edited by the Director of Agriculture
(Assisted by the Staff of the Agricultural Department).

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EDITORIAL.

Contributions and correspondence regarding subjects affecting the farming industry of Southern Rhodesia are invited. All communications regarding these matters and advertisements should be addressed to:—The Editor, Department of Agriculture, Salisbury.

Price of Crown Land.—Arising out of the recommendations of the Price of Crown Land Committee the Government has decided to grant a moratorium for a period of three years on capital payments and outstandings due in respect of Agreements of Purchase and Permits of Occupation, and has further decided to appoint a Committee to enquire into and make recommendations with regard to all applications for reductions in the price of Crown Land at present under occupation.

The Committee will be required, in addition, to advise on the terms of repayment, on conclusion of the moratorium, which should be required of persons who are in arrears with instalments or rental.

Applications for reduction of purchase price must be received by the Department of Lands, Salisbury, on or before the 30th April, 1933, together with a statement of facts upon which the claim is based.

Holders of land under the Soldier Settlement Scheme and Empire Settlement Scheme respectively—to whom assistance in other forms has already been accorded—are ineligible for further consideration under the terms of reference of this Committee. The decision as to whether actual inspection of the land or farm, in respect of which a claim for reduction in purchase price is submitted, is necessary or not will rest with the Committee.

The personnel of the Committee is as under:—

Dr. Charles Brain, Director of Agriculture, Chairman;
Mr. James Watson;
Mr. James Grant;
Mr. Frank Brooks, Lands Department;
Mr. J. H. Hampton, Lands Department; or
Mr. R. C. Boyes, Lands Department.

South African Farmers' Tour of Great Britain.—Intimation has been received from the British National Union that a further tour of Great Britain by South African farmers is being organised for the current year. Southern Rhodesia has been well represented on these tours in the past and the Union expresses the hope that we may not remain unrepresented in the present instance.

It is stated that motor coaches will be used for travelling from place to place in Great Britain and that the two great agricultural shows of the year, namely, the Royal Show at Derby and the "Highland" at Dundee, will be included in the itinerary, not to mention the famous Military Tattoo in Aldershot.

The cost, including second-class steamship accommodation, will be £162, and members of the party will, if they desire, have the opportunity at the close of the tour of prolonging their stay in the Old Country for a few extra weeks.

Departure from Capetown will be by the Union-Castle R.M.S. "Windsor Castle" on 26th May, due in London on 12th June.

The tour includes inspection of the Smithfield and Covent Garden markets, a visit to the Fen Districts of Lincolnshire, to the Lake District famous for the beauty of its scenery, to

the Druid remains at Stonehenge, and to the New Forest, together, of course, with inspection of other farming areas, famous farms and centres of commercial interest.

Further particulars are obtainable from the Chairman, South African National Union, P.O. Box 1920, Johannesburg.

Inspection and Export of Chilled Beef.—Attention is directed to the publication in this issue of the regulations for the inspection of chilled beef for export overseas and to the accompanying article by Dr. A. E. Romyn, Senior Animal Husbandry Officer, on the type of cattle required for this trade.

It seems not too much to hope that the Colony stands to-day on the threshold of an era of regular shipments of chilled beef to the home market. The two initial shipments already made have been favourably received and it is understood that the Rhodesia Export and Cold Storage Company, Bulawayo, has completed arrangements for continued chilling and export for at least several months to come.

It will be noted that a more or less definite type of steer is called for under the regulations, and breeders and sellers of cattle for this trade should give close attention both to the definitions of the class of animal required and to the further notes on the matter now provided by the Senior Animal Husbandry Officer.

To build up a successful trade it is essential that rejections of carcases should be reduced to a minimum, and this will only be achieved by a thorough knowledge by all concerned of the class of animal which will produce an acceptable quality of chilled beef.

Good Farming Rewarded—(*Errata*).—With reference to the editorial entitled "Good Farming Rewarded" which appeared on page 172 of the March issue of this Journal, we apologise for the omission of the name of Mr. A. F. Douglas in connection with the farming operations conducted on the section of the farm referred to. The section is leased to Messrs. Gilchrist and Douglas.

Increased Production in Agriculture.—The Institute of Research in Agricultural Engineering, University of Oxford, has recently published a pamphlet containing four papers which were read at a meeting of the Agricultural Section of the British Association in September last at York. The common subject of all these papers is increased agricultural production by means of mechanical equipment. Interesting examples are cited of the manner in which costs of production have been decreased in the British Isles by the judicious employment of mechanical equipment, but perhaps the paper of outstanding significance to this Colony is the one read by Mr. A. I. Hosier, and which is reproduced in this issue.

The facts presented by Mr. Hosier and which are vouched for by the authority under which the pamphlet is printed, should provide stimulating reading to many Rhodesian farmers, recording as they do the achievements of a practical fellow-farmer gifted with foresight, energy and organising ability.

The references to hay-making and grass ensilage and the labour-saving devices employed in handling these fodders alone justify reproduction of the article.

Turf Lawns and Greens.—The first part of an article on the production and maintenance of turf for lawns and sporting purposes appears in this issue. The appearance of the later part dealing with maintenance is postponed until the return of the writer from England where he is now on leave and proposes to visit the St. Ives Research Station established about six years ago by the British Golf Unions near Bingley in Yorkshire. He will thus be able to put himself in touch with the latest results obtained there and in other parts of the world, for incorporation in the concluding portion of this article.

A Manual on Green Manuring.—The Department of Agriculture of Ceylon has recently published a manual on green manuring which extends to 190 pages, with 34 illus-

trations and figures, and which summarises in a most comprehensive manner the results of investigations into this practice so far as they apply to Ceylon conditions.

It is shown that the judicious employment of green manuring and cover crops improves the physical condition and moisture retaining powers of the soil, maintains the supply of nitrogen and carbon and checks soil erosion. A legume yielding 4 tons of green material per acre, containing .6 per cent. of nitrogen, has been found to add at least 50 lbs. of nitrogen per acre to the land.

Dealing with the conservation of soil moisture it has been found at Peradeniya that the first two years' growth of a cover crop causes a loss of soil moisture due to transpiration of moisture from this crop, but that once the cover is well established and a surface mulch of organic matter has been established over the land, a larger amount of soil moisture is retained than in the absence of a cover crop.

Considerable space is devoted to a discussion of the fungoid and insect pests to which various of the green manure crops are liable and the relation of these to the major crops of the Island, including tea and coffee. The relative merits or otherwise of a wide range of green manure crops are considered and typical analyses are supplied of leguminous and non-leguminous green manuring plants.

The publication should prove of particular interest to tea and coffee planters in Rhodesia and adjoining territories, and perhaps also to orchardists. It is obtainable from the Manager, Publication Department, Peradeniya, Ceylon, at a cost of Rs.5, to which must be added postage charges.

A PRELIMINARY NOTE ON CONTAGIOUS GRANULAR VAGINITIS IN SOUTHERN RHODESIA

By D. A. Lawrence, B.V.Sc.
(Acting Director Veterinary Research).

In the majority of the very large number of articles written on this disease it would appear that the authors have been principally concerned with the controversial question as to the part played by this affection in the causation of sterility.

Many authorities appear to be of opinion that vaginitis is of great importance as a causative factor in sterility, but most of these admit that the sterility produced can at the most be regarded as only a temporary condition.

Amongst the above may be included Quinlan, of the Veterinary Research Department at Onderstepoort, Pretoria, who has devoted considerable time to the study of sterility amongst breeding cattle in South Africa.

Others, amongst whom may be included such a leading authority as Albrechtsen, can demonstrate no connection between this disease and sterility, in fact Albrechtsen states that "I look upon follicular vaginitis as a non-malignant disease, which has nothing to do with sterility or, at least, is seldom associated with it and the treatment of which is without influence on normal breeding."

Others again have asserted that vaginitis is the cause of abortion, but it is doubtful whether these opinions are still supported to-day in view of the overwhelming evidence against this possibility.

In this article, however, it is not the intention to enter into this aspect of the subject except in respect of a limited

number of observations conducted during the past few months in breeding herds near Salisbury.

These observations have definitely shown that contagious granular vaginitis may and does exist in dairy herds in which not the slightest breeding troubles have ever been experienced.

That the disease has been diagnosed more frequently in herds where non-breeders are common is readily admitted, but in my opinion this is entirely due to the fact that it is only in such herds that any diseases of the genital tract are ever looked for. Recently, however, I have carried out examinations amongst herds where the breeding records were such as to satisfy the owner that any examination for disease would be futile, but nevertheless even in such cases as many as 35 per cent. of the female breeding stock were found to be infected.

In his annual report for the year 1931 the Chief Veterinary Surgeon has indicated that this disease is more prevalent than is generally supposed, and it is therefore deemed advisable that the stock owner should be informed as to the nature of the disease, its symptoms and methods of treatment and control.

Definition.—Contagious granular vaginitis is a disease of the mucous membrane of those portions of the genital tract which participate in coitus (vulva, vagina, sheath, prepuce and glans penis) the essential symptom of which is the appearance in the mucous membrane of nodular elevations, usually 1-2 m.m. in diameter, protruding above the surface.

The disease is infectious in character, but the actual causal agent is not definitely known, although one minute bacterium (a streptococcus) has been regarded by certain workers as being the specific germ responsible.

Symptoms.—As vaginitis is really a chronic disease the clinical picture varies considerably, depending on whether the infection is acute or of old standing. Owing to the difficulties experienced in exposing the mucous membranes of the male genital organs the description of the lesions found on examination will be restricted to those seen in cows and heifers.

In acute cases suspicion of infection may be aroused by simply looking at the vulva externally, when it may be seen

and the vulva lips may show more or less swelling. On proceeding to a close internal examination some difficulty may be experienced in opening the vulva, on account of this matting of hairs and the extreme sensitiveness of the animal to manipulation. In such cases it may be necessary to soften, e.g., with lukewarm water, the discharges before proceeding any further. The lips of the vulva should be grasped between the finger and thumb of each hand and drawn outwards and backwards, thus enabling the operator to get a good view of an extensive area of the vaginal mucous membrane. It may be noticed that the floor of the organ contains a large quantity of mucous-like pus and that the lining membrane is intensely reddened and somewhat swollen. Due to this inflammatory condition in the early stage of the disease the presence of the nodules may be difficult to detect, but usually in a good, strong light or with the aid of a torch they show up as colourless or pale, raised and more or less transparent areas about the size of a large pin's head. The first impression one gets is that these nodules are soft and like tiny blisters, but actually they are firm and granular to the touch. The nodules may be very numerous over the entire mucous membrane or may be only sparsely distributed and frequently they appear to be arranged in rows at the lower portion of the vagina. The presence of the granules or nodules is an essential feature of the disease as the name would imply.

In cases of longer standing there is usually no external indication of infection, and on examination little or no discharge can be found. The membranes appear normal in colour, or may show slightly increased redness, and the nodules accordingly may not present such a striking appearance. The older nodules are essentially the same as those described in the acute cases and can readily be felt by rubbing a finger over them.

These symptoms may occur in any female cattle, but the disease is more common in young cows and heifers.

In bulls symptoms as described above are characteristic but on account of the difficulties of examination are rarely observed.

Transmission.—Infection is considered to be usually transmitted from an infected animal by copulation, but as heifers which have never been served also readily become

one. Infection may result from close contact with infected animals or material contaminated with their discharges, and certain authors express the opinion that infection of calves may result through drinking the milk of infected cows. Experimental evidence of the disease having been transmitted through milk is, however, not forthcoming, and it would appear that as only some calves in a dairy herd where bucket feeding is practised become infected, this method of transmission occurs only exceptionally, if ever.

Treatment.—In considering the question of treatment a difficulty is at once apparent. If the disease is a harmless condition, as in many cases it no doubt is, treatment would appear to be quite uncalled for. In other cases, cows which are non-breeders or irregular breeders may be found to be infected, and in such the failure to conceive is often attributed to this infection, whereas actually it may be due to some condition which is in no way associated with vaginitis, e.g., diseases of the ovary, fallopian tubes, uterus or cervix, or purely functional sterility such as overfat condition, lack of exercise, etc.

In herds, therefore, where there is no indication that the disease is having any effect on breeding, it would appear unnecessary to undertake treatment. Local treatment is the only method which can be applied and its application may possibly cause infections other than vaginitis to be carried from one cow to another unless strict precautions are taken.

Where animals which fail to conceive are observed to be infected with vaginitis it is advisable to obtain a veterinary examination, and if this reveals an otherwise normal condition of the animal treatment for vaginitis should be undertaken.

The treatment recommended is the application of "Vaginaline" in strict accordance with the instructions issued with this powder, i.e., thorough cleanliness, preliminary douching with an alkaline salt solution and a course of vaginal insufflation with Vaginaline. All breeding should be suspended during treatment for 4 to 6 weeks.

Treatment of this nature is stated to be giving highly successful results in South Africa and Kenya Colony.

Investigations as to the efficacy of the method are at present in progress in Southern Rhodesia and it is anticipated that it will be possible to make a further statement in this

NOTES ON AFRICAN ALOES.

By H. Basil Christian, Ewanrigg, Arcturus.

PART VII.

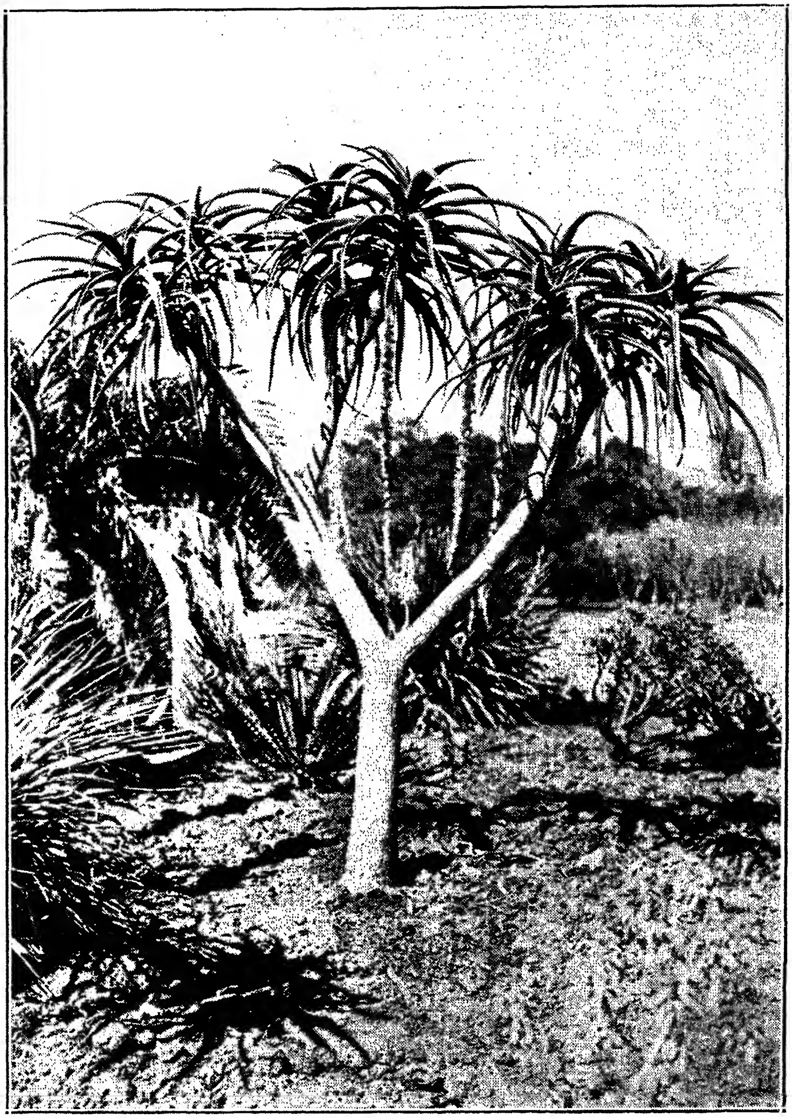
Aloe Bainesii.—Aloe Bainesii is one of the two giant tree aloes of Southern Africa, the other being A. dichotoma, which is confined to the West Coast, Namaqualand being its home, whereas A. Bainesii occurs along the south-east coast from Kaffraria to as far north as Portuguese East Africa.

This aloe thrives under Southern Rhodesian conditions, flowering regularly every year, when once it has reached flowering size. The plant illustrated is growing in Sir Ernest Montagu's garden and was planted as a cutting in 1915.

The flowers are very bold and fine and appear at their best when the plant is young and not more than 6 ft. to 8 ft. high. At this stage they can be seen to their greatest advantage. Owing to the fact that the inflorescence is somewhat on the short side, when the plant increases in height it becomes more and more difficult to see the flowers which are hidden by the leaves below them.

A somewhat distinctive feature of this aloe is the fact that the leaves, where they clasp the stem, usually leave a whitish-green margin about ¼ inch wide.

Description.—Arborescent, with a trunk reaching a height of 50 ft. to 60 ft. and a diameter of 4 ft. to 5 ft.; diameter of leafy head, 20 ft. or more; leaves ensiform, 2 ft. to 3 ft. long in the young state, but much shorter in the mature plant, 1½ to 2 ins. broad low down, tapering gradually to the apex, green, unspotted, not prickly on the keel towards the tip; margin with distant, deltoid, horny prickles, 1-12 to ⅛ in. long; peduncle and rachis very stout and woody; racemes dense, oblong, 3 to 4 ins. long; pedicels stout, erecto-patent, ⅛ to 1-6in. long; bracts minute, lanceolate; perianth



A. Bainesii.

A. Grandidentata.

oblong, $1\frac{1}{2}$ ins. long, $\frac{1}{2}$ in. diameter, salmon-pink fading into whitish, tipped with green; tube campanulate; outer segments valvate; stamens and style much exserted.

A. Grandidentata.—Aloe grandidentata is widely distributed over the north central portion of South Africa from Kimberley, Bloemfontein, Johannesburg, Mafeking, north into Bechuanaland. It is one of the smaller acaulescent, or subacaulescent spotted leaf aloes, the leaf markings varying very considerably in different localities, but the leaves are always thicker in the upper than the lower part with the leaf markings appearing on both upper and lower surfaces. It grows to a height of 3 ft. to the top of the inflorescence, which is very similar to that of A. transvaalensis and is generally found growing in family groups. Its habit of sending out underground runners, which throw up plants some distance from the parent, is a bit of a nuisance in a rock garden, where space is usually limited, but these can always be taken out if necessary and, in this respect, it is not as bad an offender as A. Greenii.

Description.—A subacaulescent plant with a basal rosette of leaves, 0.6 to 1.0 m. high including inflorescence. Leaves 2 to 8 series, up to 11 cm. long, 5.7 cm. broad, oblong-elliptic, convex on both surfaces, thicker in the upper part than the lower part, usually suddenly contracted in a dried-up terminal portion, mottled with lighter irregular areas on both upper and lower surfaces, toothed on the margin. Peduncle erect, terete, usually branched into two to five branches, rarely simple, covered with a greyish powdery pubescence. Pedicels up to 1 cm. long, spreading or ascending, becoming pendulous with age. Perianth, in open flowers, 2 to 2.3 cm. long, somewhat campanulate; practically no bulb at the base; lobes 8 mm. long, 4 mm. broad, ovate-lanceolate, obtuse. Stamens inserted at base of perianth anthers 3.5 mm. long, ellipsoid. Ovary ellipsoid, style terete; stigma small, capitate.

Aloe Tenuior.—Aloe tenuior is one of the creeping or climbing aloes and is found in the Eastern Province of the Cape between Port Elizabeth and Grahamstown. It is often found growing amongst bushes through which it pushes its way until the ends of its branches get out into the sun and

light. When grown in the open on the flat, away from plants taller than itself, it often assumes a shrubby form and it then appears at its best. The writer has seen this aloe and A. ciliiaris, another of the climbing aloes, trained along a trellis where they were both growing to perfection, but the sight of aloes which usually occur in the wildest, most rugged country, being trained over anything as artificial as a trellis, was too horrible for words.

Under Southern Rhodesian conditions this aloe does very well, having three or four flowering periods during the year. With its rather small glaucous green leaves and dense racemes of bright, canary yellow flowers, with the stamens and style well exserted, it is a very pretty sight when in flower.

Description.—Stem many yards long when fully developed, sarmentose; branches tevete, ¼ to 1-3 in. diameter, internodes ½ in to 1 in. long, obscurely striped with green; leaves linear, 6 to 8 ins. long, about ½ in. broad low down, 1-12 in. thick in centre, plain green, not auricled at base; all the marginal teeth very minute; peduncles slender, simple, 6 to 9 ins. long; racemes moderately dense, 4 to 6 ins. long; the lower pedicels ¼ to 1-3 in. long; the bracts very minute; the perianth cylindrical, pale yellow, 1-3 to ½ in. long; the segments short, ovate; the stamens and style both distinctly exserted.

A. Tenuior.

INFESTATION OF STORED PRODUCTS BY INSECTS.

By Prof. J. W. Munro,
Imperial College of Science and Technology.

Although the losses caused to growing crops by insects have long been recognised, the losses caused to crops after harvesting and during storage and transport have been strangely neglected both by the biologist and the industrialist. These losses are none the less of grave importance and take in the main three forms: absolute loss of goods resulting from consumption by the insect, indirect loss resulting from the lower price paid for soiled or infested produce and indirect loss resulting from loss of prestige by the merchant or manufacturer who inadvertently places infested produce on the market. This last form of loss is almost wholly incalculable, but that it is high is evident from the almost extravagant care which our food industries take to prevent any knowledge of infestation from reaching the general public.

In 1926, the Empire Marketing Board appointed a committee—Committee on Stored Products Infestation—to consider this problem and on its recommendation made a grant to the Imperial College, in 1927, for the establishment of a special laboratory for the study of the scientific problems underlying infestation of stored products by insects and fungi.* This laboratory is stationed at Slough, near London. Its work is divisible into three main sections: survey and intelligence work at the London docks; research and experimental work in the laboratory; and commercial scale experimental work on sterilisation of infested produce and warehouses in London and other ports.

* The term "stored products" as used here excludes timber, which is dealt with by the Forest Products Research Laboratory of the Department of Scientific and Industrial Research.

The survey or intelligence work is concerned with inspection of such produce as cocoa, dried fruits and tobacco on its arrival in London, with a study of the special conditions—economic and climatic—prevailing in the dock warehouses and their relationship to infestation, and with the examination of special "experimental consignments" of produce shipped from oversea for the purpose of testing methods of preparation, packing and transport and their relationship to insect infestation. With this inspection work there is also regular correspondence and exchange of programmes with departments of agriculture and other institutions in the Dominions and Colonies on problems arising in the work.

A survey of the insects associated with cocoa, dried fruits, spices and tobacco stored in London warehouses showed that upwards of a hundred and forty species of insect are represented, but of these only a few are of primary importance. These are the phycitid moths of the genera *Ephestia* and *Plodia*, of which the "flour moth," *Ephestia kuhniella*, the "cocoa moth," *Ephestia elutella*—which is also a serious pest of stored tobacco—and the Indian meal moth, *Plodia interpunctella*—the major pest of dried fruits—are much the most important economically. Of the Coleoptera, the grain weevils, *Sitophilus granaria* and *S. oryzae*; the flour beetle, *Tribolium castaneum*; the "saw-toothed grain beetle," *Oryzæphilus surinamensis*; the "biscuit weevil," *Sitodrepa panicea* and *Ptinus* and *Dermestes* species, are the more important or more prevalent.

The characteristics of the stored products fauna have been discussed by van Emden and by Richards. The chief of these appear to be low water requirements and lack of specialised oviposition response.

The main results of the survey work so far have been to show that in nearly all—if not all—instances, infestation begins in the exporting country and that it is aggravated by storage in Great Britain. The work has also served to show that close co-operation of the producers, merchants, wharfingers and manufacturers is essential if freedom from infestation problems is to be attained. In the dried fruit industry it has been clearly shown that due precautions taken in the

packing sheds of the exporting country will ensure lower insect infestation of fruit on its arrival in Great Britain.

The laboratory research and experimental investigations in progress comprise entomological, mycological and chemical work. In the entomological branch, the problems studied are concerned mainly with the rearing of very large numbers of insects for experimental work on such lethal agents as heat, cold and fumigant gases, and with various problems relating to the respiration of insects in different stages of development. Of special interest is a study of the factors governing the fertility and rates of increase of the phycitid moths. A description of the pairing habits of these moths has been published and an account of sterility produced in the males by rearing at temperatures above the optimum for development awaits publication.

In the mycological branch of the laboratory, special attention has been given to copra and to cocoa and an extensive programme of work on the taxonomy and physiology of the mould-causing fungi of the genera *Penicillium* and *Aspergillus* has been begun.

In the chemical section of the laboratory, research and experimental work on the relative toxicity of various fumigants to insects and on the partial vapour pressures of fumigant vapours and gases generally used in admixture, for example, ethylene dichloride and trichlorethylene has been carried out and awaits publication. Especially important is a study of the methods of measuring the concentration of gases during fumigation and the devising of special apparatus for this purpose. Work on the methods of determination of the fumigants ethylene oxide and hydrocyanic acid, both in the air spaces and in the products fumigated has made good progress.

The commercial scale experimental work undertaken by the laboratory has been made possible by the generous facilities placed at its disposal by a number of interested firms, among whom Messrs. Weber, Smith and Hoare, wharfingers, and the London agency of the Australian Dried Fruits Board deserve special mention. While laboratory experimental work has very high value, it is almost impossible to simulate in the laboratory the extraordinarily varied

conditions affecting sterilisation on a commercial scale. Where cold lethal temperatures are employed, the chambers used in commercial cold storage have been found satisfactory and this method is especially applicable to the sterilisation of almonds and nuts and tobacco. Where, however, fumigation is employed, the problems are many and difficult, for some of these warehouses have a capacity of 250,000 cubic feet and house many hundreds of tons of produce.

In fumigation of ships, warehouses, mills and produce as practised commercially, it was found that no serious attempts are made to determine the behaviour of the gases used during the actual process of fumigation. Moreover, such concentrations of fumigants as are recommended or employed in practice are based on experimental work in which the kind and extent of living insect material used are quite inadequate. Five, ten or, in rarer cases, thirty insects of unknown antecedents appear to be considered ample for this work. In our experience, such numbers are far too small and until we were employing in our commercial work from 2,000 to 4,000 insects or insect eggs reared or produced under known conditions, we were not satisfied with our results. A study of the behaviour of gases during fumigation showed that temperature effects are not allowed for at all, the very high absorption of fumigants by the products themselves and by such things as walls and "dunnage"—boards used as a base for piles of fruit boxes, sacks, etc.—is altogether underestimated and quite inadequate measures are taken to ensure proper diffusion and distribution of the gas. It is probable that the most important direct contribution our laboratory has so far made to the "control" of insect infestation is in directing attention to these defects and providing means of overcoming them. The methods used in measuring concentrations of gases in fumigation have already been described elsewhere; meanwhile, two very important advances in the technique of fumigation have followed. On one hand a higher percentage of destruction of the insects has been secured, and on the other, a more uniform distribution of the gas has been attained, even in very large warehouses in cold weather. This work is, of course, still in the experimental stage, but there is every reason to hope that soon we may

find commercial fumigation placed on a scientific basis, with the result that it will be safer for those engaged in it, more efficient against insects and less injurious to the product treated.

Efficient fumigation, however, is not the final aim of our work, which is the reduction of infestation at its source, and while physical and chemical measures may prove palliative, it cannot be too strongly emphasised that the ultimate reduction of the losses caused by insect infestation of stored produce depends on the acquisition of a fuller knowledge of the insects concerned than we possess at present. Subjects on which promising research work is being conducted as time and funds allow are the temperature and humidity conditions —both in the atmosphere and in the products—which are most favourable to various insects, and the relationship of the mould-causing fungi to the insects' food supply. For the present, this research work may appear of less practical importance than the improvement of remedial measures, but as these measures lessen the incidence and extent of infestation and more attention is given to preventive measures, the value of the more purely biological research work will be more appreciated. Already in some of the industries affected by insect infestation of their raw materials, the need is felt for fuller knowledge of the influence of ventilation and air conditioning and of different kinds and intensity of lighting on the prevalence of warehouse insects.—"Nature," 21st January, 1933.

THE TYPE OF CHILLER STEER REQUIRED FOR EXPORT.

A. E. Romyn, Senior Animal Husbandry Officer.

In December last a conference between representatives of various South African territories was held in Pretoria to discuss the question of the export of chilled meat and to secure uniformity of policy in regard to export regulations.

The regulations detailed in this article were adopted at the meeting. They apply to all chilled meat exported from Union ports and, therefore, to meat exported from this Colony by those routes. There are no restrictions on the quality of the frozen beef exported other than those imposed for health reasons, and cattle which do not attain chilled meat standard can be exported as frozen beef in some form or as a tinned product.

REGULATIONS FOR EXPORT OF CHILLED BEEF.

Definitions.—(a) The prescribed age is defined as not more than five years for all cattle except those showing a preponderance of Afrikander or Simmenthaler blood, which may for a period of twelve months from the date of publication of this notice be passed up to six years of age.

(b) Beef conformation is defined as relatively short shanks and neck, plump rounds and full loins, well fleshed shoulders and ribs, depth of flank commensurate with depth of chest. Carcases showing extreme angularity, prominent hip and shoulder bones, shallow loins, flat ribs and long thin rounds will not be passed.

(c) Satisfactory finish is defined as: a moderate covering of firm, white or creamy white fat over the exterior surface of the carcase, particularly over the ribs, loins and upper parts of the shoulders and the rounds; a moderate kidney

knob and a generous quantity of crotch fat; a noticeable distribution of wavy fat over the inner surface of the ribs, i.e., the walls of the chest; a liberal distribution of fat in the lean, displayed in the cross section of the *longissimus dorsi* at the point of quartering. Carcases showing deficiency in external fat covering as indicated by patches of dark flesh over loin, shoulder, round or ribs and a general scraggy appearance of the quarters, absence of internal fat on the walls of the chest, a deficient kidney knob, soft and yellow fat, will not be passed.

(d) Condition includes temperature and, under regulations enforced by the Government of the Union of South Africa, chilled beef exported from any port of the Union of South Africa shall, when tested with a piercing thermometer, show a temperature of not less than 28 degrees Fahrenheit and not more than 36 degrees Fahrenheit.

(e) Inspector shall mean a person appointed by His Excellency the Governor to examine chilled beef for export.

(f) Certificate means a certificate issued by the Government Inspector of Meat.

(g) Minister shall mean the Minister administering the Department of Agriculture and Lands.

2. No chilled beef shall be exported to the United Kingdom unless:—

(a) it has been examined and certified by a Government Inspector;

(b) in the opinion of an Inspector it is derived from oxen of the prescribed age or open or spayed heifers of the prescribed age, of beef conformation and carrying a satisfactory finish;

(c) it is free from mutilations, bruises and taint, properly dressed and properly chilled and bright and sound in condition;

(d) each quarter has been duly stamped by a Government Inspector as follows: "S. Rhodesia Government Inspected";

(e) it is wrapped in an inner covering of white stockinette and an outer covering of either hessian or stockinette;

(f) it is accompanied by a certificate set out in Schedule "a" of these regulations.

3. Appeals against the decision of or action taken by an Inspector shall be lodged with the Minister within a period of one month from the date of such decision or action, but the Government will not hold itself responsible for any loss or inconvenience suffered by a prospective exporter or agent of such exporter by reason of any such decision or action of an Inspector.

* * * *

The purpose of these regulations is to ensure that meat of inferior quality will not be shipped as "chilled beef." The actual grading of the meat is left to the exporter. No limits have been laid down for weight. Although a market can be found for most weights in the United Kingdom, the size of carcase preferred is one of from 600 to 650 lbs. or lighter. It will probably be found necessary to keep veld reared cattle until they reach carcase weights of at least 600 to 650 lbs. before they are sufficiently finished for export. Stall-fed cattle can, however, be marketed at lighter weights and, except where grazing is very cheap, the steer that has matured earlier as a result of supplementary feeding has a decided economic advantage over the older animal. The feeding of concentrates, moreover, improves the quality of the meat and gives a bloom to the carcase which is lacking in purely grass-fed beef.

For purpose of illustration three photographs of groups of steers which sold well in the first consignment of Rhodesian chilled beef to Smithfield have been reproduced here. Fig. 1, lot 1, consisted of grade Aberdeen Angus steers, four years old, approximate dead weight 625 lbs. These steers on the hoof showed the desired conformation, quality, uniformity and finish. On the hook the carcases lacked a little in covering on the rounds and near the hocks. The Smithfield report described them as "the quality required by the London market." They were fed on concentrates, hay and silage for three and a half months.

Fig. 2, lot 2, was made up of high grade Hereford steers, three and a half years old, approximate dead weight 730 lbs.

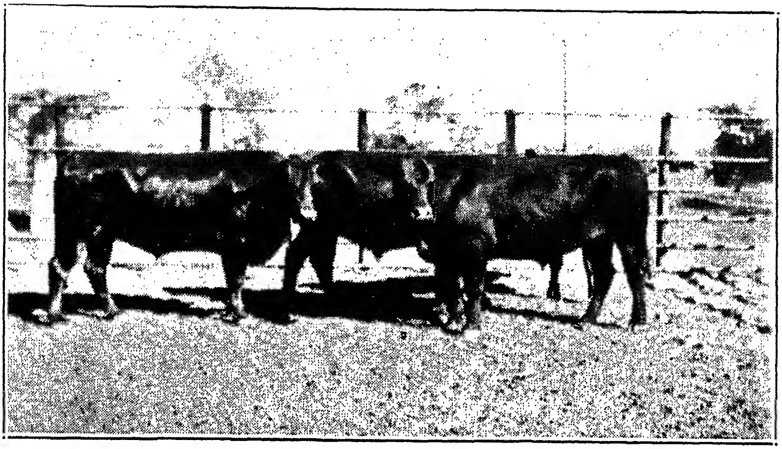


Fig. 1. Grade Aberdeen Angus steers suitable for the chilled meat trade.

Fig. 2. High grade Hereford steers.

On the hoof these steers were uniform, well topped, unusually level in the hind quarter, but some were a bit leggy. They did not show quite the quality of lot 1. On the hook the carcases looked exceptionally well. They were well covered on the loins, well balanced and the meat was a very good colour. Possibly the period of good supplementary feed was responsible for the bloom. The carcases were, however, a little heavy. The London report described this lot as "a very useful parcel, uniform in quality and well covered." The steers were fed concentrates, hay and silage for four months.

Fig. 3, lot 3, consisted mostly of grade Angus and Shorthorn steers, five and six years old, approximate dead weight 750 lbs. On the hoof the bullocks were rather plain in conformation and light in the hind quarters, but well covered. On the hook the carcases were somewhat disappointing and heavy in the fore-quarters. The meat was dark but cut up surprisingly well. The London report states that this lot was "a useful parcel, but some of the quarters showed age and were rather staggy." These bullocks were entirely grass fed.

Lots 1 and 2 represent as good a type as this Colony can produce at the present. There is, however, a good market for steers of the type of lot 3, provided these are marketed before they are too old. Indeed, from the standpoint of the producer, this type, on good veld, may be the most profitable class of the three.

It is estimated that seventy per cent. of the grade beef or dual purpose bullocks raised at present and over fifty per cent. of the bullocks produced by the first cross of a good beef bull on an improved native cow should attain the export standard, provided they are not over five years of age and are properly finished.

By the feeding of weaners during their first winter the age of marketing can, where necessary, be brought within the four to five years limit without much difficulty. The main difficulty is not age, however, but the obtaining of a satisfactory finish before the bullocks are over age. The rejections among four to five year old veld reared bullocks for lack of finish, in the Union consignments and our own, have so far been very heavy—not less than fifty per cent.

From our present information of the market it is doubtful whether veld reared cattle can take on the finish required by these regulations except for a brief period of the year and on good veld. A common criticism of the general run of grade ranch bullocks is that they are rough, over age, and lack the quality required for the chilled beef trade. Practically all the younger veld-reared bullocks exported from Southern Rhodesia and the Union have been criticised overseas as lacking somewhat in finish and, to market bullocks in any quantity from June to December, it will be necessary to do a certain amount of supplementary feeding. The nature and extent of this feeding will depend upon circumstances.

Information on the fattening of bullocks will be published in a later issue.

HANDBOOK OF TOBACCO DISEASES.

Attention of readers is drawn to the fact that the Department of Agriculture has found it most inconvenient, with the present shortage of staff, to handle the local sales of this book. Arrangements have therefore been made with the Rhodesian Printing and Publishing Company for distribution by them throughout Southern Rhodesia. The book may be obtained from the Herald Store, Salisbury, price 4s., or, postage paid, 4s. 4d.

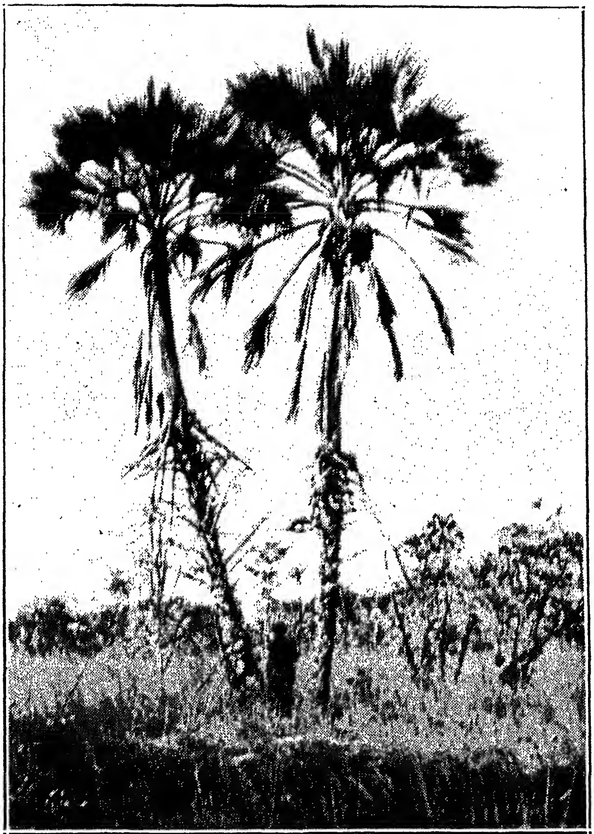
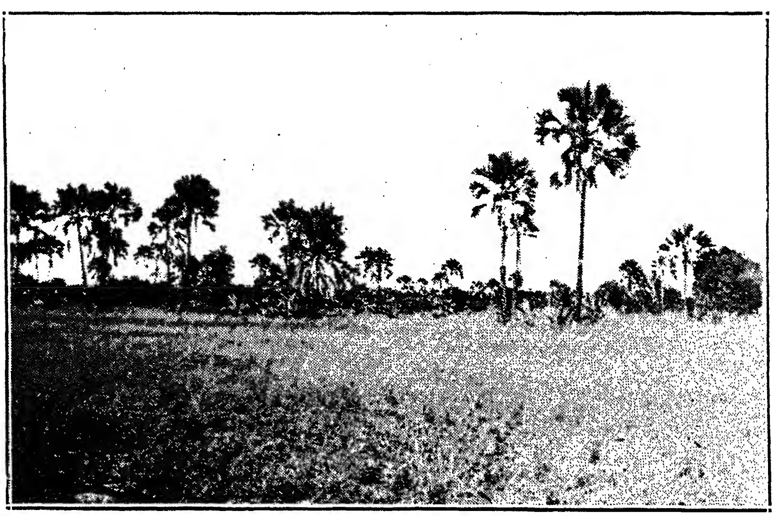


Plate No. 1.



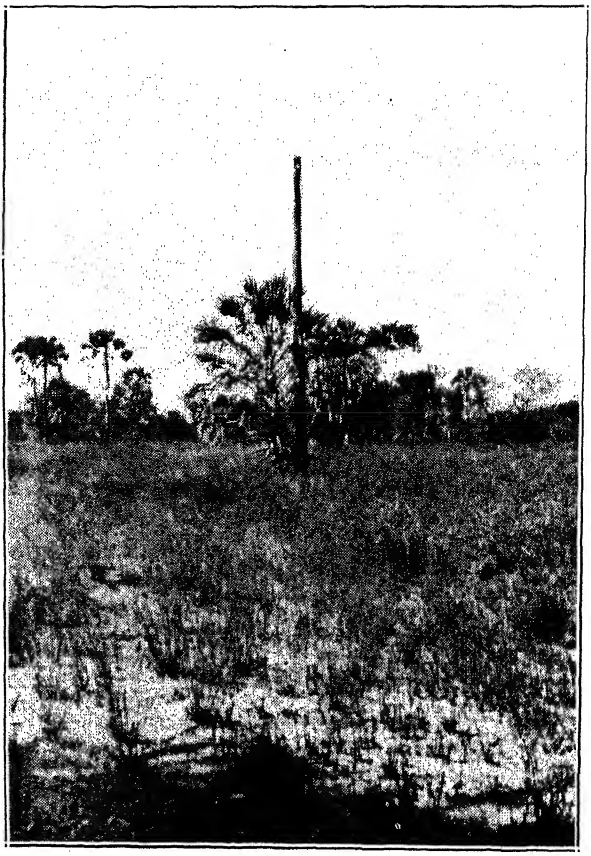


Plate No. 3.

THE VEGETABLE IVORY PALM.

(*Hyphæne ventricosa*).

By G. M. McGregor, B.Sc., District Forest Officer,
Matabeleland.

The "Vegetable Ivory" or "Mulala" Palm, which occurs elsewhere in the low-lying portions of the Colony, is found in profusion on the Ngamo Flats of the Wankie district. This area, sometimes known as the Valley of the Thousand Vleis, is extremely flat, as is indicated by the fact that it is traversed by the great 70-mile railway "straight" between Gwaai and Dett. The soil is very shallow and badly drained, each depression being a potential pan, though very few of these pans carry water throughout the year.

Grass is abundant, and is only interrupted by slight elevations which carry small tree and shrub growth. The chief species are citamusi, mangwe and hardekol, with occasional wild syringa or umnondo. While, therefore, a portion of the Flats is typical open grassland, the greater part, by far, consists of grassland studded with clusters of slightly elevated ground carrying tree, bush and shrub growth. These "islands" vary considerably in size, but the vegetation they carry is almost constant.

The palm is somewhat irregular in its distribution, in which the occurrence of annual fires plays a large part. Typical fire damage is depicted in Plate No. 3. As a rule, the palm is found on the slight slopes of the many pans or on the "islands" formed by the other vegetation, but it also occurs in the grassland proper. The palms are found individually or in clusters up to sixty. (*Vide* Plate No. 2).

The sexes are separate, and both a male and a female tree can be seen in Plate No. 1. The fruits are borne on spadices, usually five per tree, which arise from the axils

of the lower leaves. The spadices are pendulous and bear up to 200 fruits each. A heavily laden tree was found to contain 953 fruits. The female tree in Plate No. 1 contains about 800 fruits. Many trees, however, only contain from one to four spadices, and often the number of fruits per spadix does not exceed two dozen. On the average, a tree carries about 450 fruits.

The green fruit is the size of a tennis ball and weighs about 6 ozs. It has a spongy casing, which is eaten by natives. This casing is relatively soft, and when the fruit falls to the ground, it soon rots, and would probably rot naturally in two years. Normally, however, fires reduce the casing within the first year and then the hard covering is left. At this stage the fruit resembles a miniature cocoanut with its woody-like and extremely tough covering, which is of fibrous texture and very difficult to open. On being opened, the "ivory" or seed is revealed.

In the green fruit the ivory is fairly soft, but it hardens on exposure. The placentation is basal, and the plumule and radicle are easily removed.

The ivory is hollow and contains a milk similar in taste and colour to the cocoanut. This milk is relished by Bushmen. In shape the ivory is like an onion, measuring about 1½ inches across and about 1⅛ inches in depth. If the ivory is cut across, a thickness of about ¼ inch of endosperm or solid ivory is revealed.

A mature tree has about 35 feet of clear bole and a total height of about 45 feet. The trees retain their dead leaves until they bear flowers, when the leaves immediately under the crown fall. In succeeding years more leaves fall from above and so on until the oldest leaves, i.e., those nearest the ground, are the last to be cast off. This is clearly seen in Plate No. 1. It appears that fruit is borne in the greatest abundance just after the casting off of the last leaves. The bole of the mature tree is on an average 12 inches in diameter and there is no taper.

The leaves are typically palmate, and the lamina is very well armed with thorns, some of which are backwards directed.

A survey of 17 square miles of the Ngamo Flats revealed that the average number of large trees was 1,200 per square mile, though in the densest 10 square miles the number was 1,700. Of this 1,200, ten detailed sample plots showed that 400 were fruiting females, 500 were males and the remaining 300, while apparently mature, revealed no sex. Thus only 33 per cent. of the crop consists of fruiting females.

On the basis of 400 fruiting trees each with 450 fruits the yield of fruits per square mile would be 180,000 fruits. Allowing 22 per cent. for non-setting of seed, a yield of about 140,000 sound fruits per square mile is obtained. The weight of ivory contained in a sound fruit is about 1 ounce, so that the yield of "ivory" per square mile may be given as at least 8,000 lbs.

Up to the present time the vegetable ivory has been put to little use except for curio carving, brooches and mounting walking sticks. As a substitute for animal ivory for certain purposes or for materials from which buttons and similar articles are made, or even the copra of commerce, the commercial possibilities of the vegetable ivory appear to be promising.

THE SALISBURY CO-OP. INDUSTRIES CREAMERY.

Issued by the DAIRY BRANCH.

A development of considerable interest as far as the dairy industry in Mashonaland is concerned is the establishment quite recently of a new creamery at Salisbury. This new concern, which has been erected by the Rhodesian Farmers' Co-operative Industries, Ltd., has now replaced the old creamery depot which was established by the same firm some ten or eleven years ago. The old creamery was a small concern, and it is of interest to note that when it commenced operations a decade ago its equipment consisted of a small hand churn with which butter was made for local consumption. Since this modest beginning, this creamery has shown a marked expansion year by year, until finally a stage was reached where its facilities in the form of equipment and cold storage were quite inadequate to handle the ever-increasing supplies of cream in Mashonaland. It has been found necessary, therefore, to replace this creamery by an entirely new and much larger concern: in establishing and equipping the latter, Messrs. The Rhodesian Farmers' Co-operative Industries, Ltd., have not only made provision for further possible expansion, but they have also been to considerable trouble and expense to equip this creamery with the best and most up-to-date plant and machinery obtainable. Their efforts and enthusiasm in this direction have been rewarded to the extent that this concern is now regarded as being one of the best equipped of its kind in South Africa.

As indicated above, the plant and machinery with which this creamery is equipped is of the most modern type, and it may be of interest, therefore, to describe briefly some of the equipment which has been installed and to explain its uses in the butter manufacturing process.

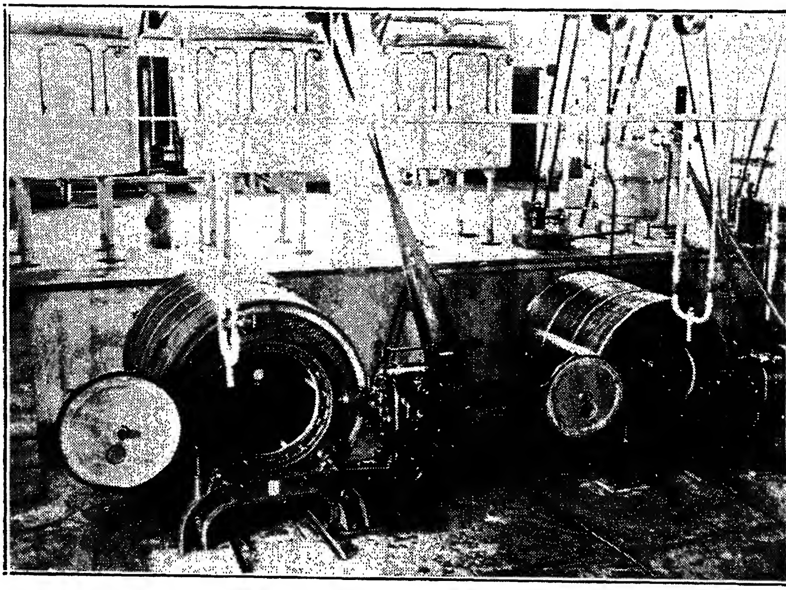


Fig. No. 1. View of interior of the creamery showing churns in the foreground, and cream treatment plant, etc., on raised platform in the background.

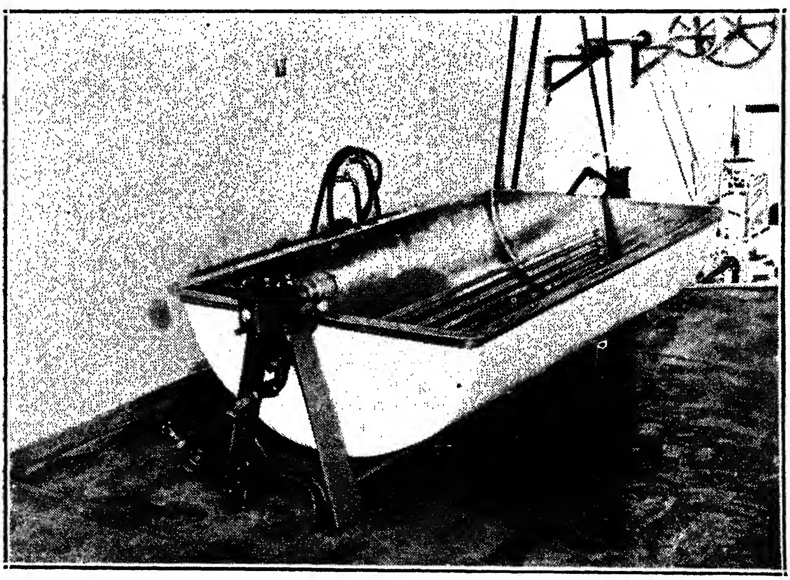


Fig. No. 2. View of forewarmer or pre-heater in which the cream is mixed, warmed and neutralised before passing to the pasteuriser. The cream is agitated, mixed and heated by means of the coil with which the forewarmer is fitted.

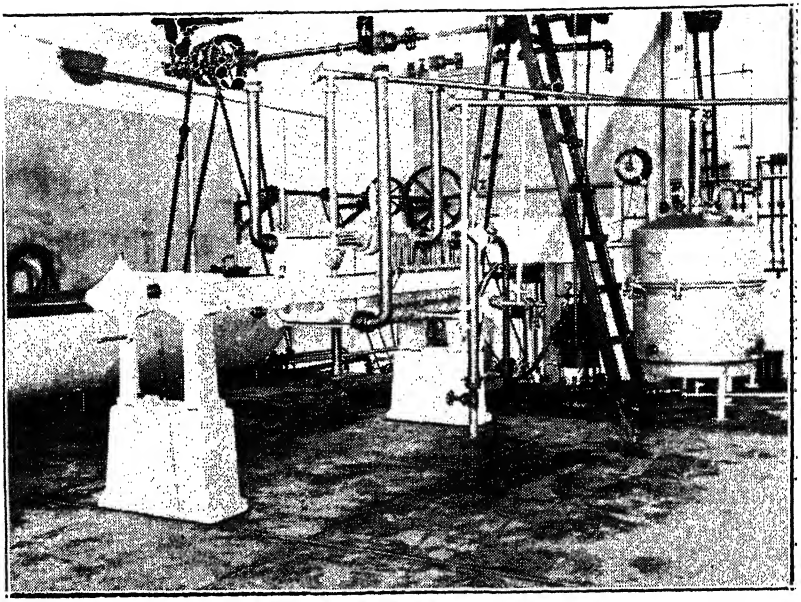


Fig. No. 3. View showing heat exchanger or pasteuriser on left and "degasser" or deodouriser on the right.

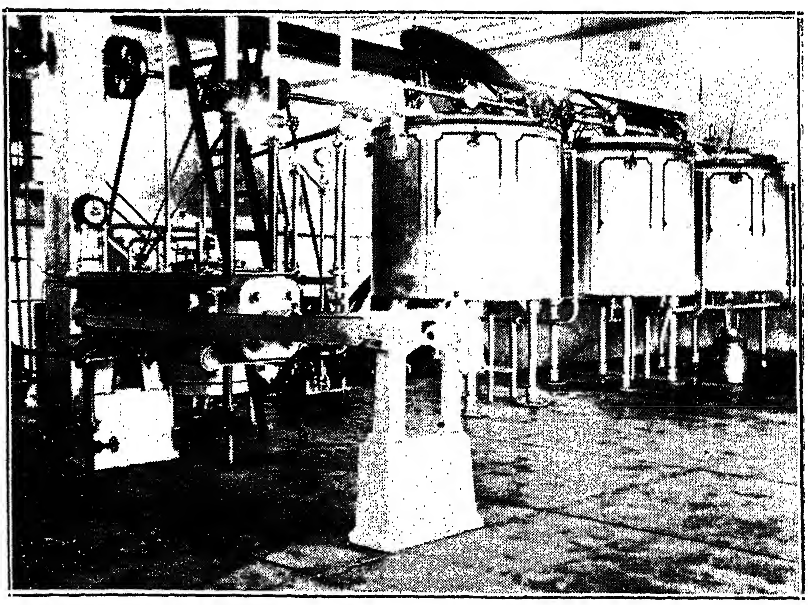


Fig. No. 4. View of the top platform of the creamery showing heat exchanger or pasteuriser and three glass-lined cream holding vats.

Contrary to popular opinion, the conversion of cream into butter on a commercial scale is by no means a simple process. Present-day conditions require that creamery butter should show quality and uniformity, and be so manufactured as to withstand deterioration in storage, etc. These requirements can only be fulfilled by subjecting the cream, etc., to various processes, and great care has to be exercised, therefore, in the selection and installation of equipment suitable for the purpose.

Before proceeding, however, to discuss the plant and machinery which has been installed for the treatment of the cream, it is perhaps necessary to say a few words in regard to the general lay-out, etc., of this creamery.

The latter is a large, well-constructed building situated on the Farmers' Co-op. stand, Salisbury. This site is convenient inasmuch as the creamery is within easy distance of the railway station from which the cream supplies are collected. Refrigeration (which is, of course, indispensable in a creamery) is provided by means of two 16-ton York ammonia compressors; the cold storage accommodation is at present sufficient to hold at least 250,000 lbs. of butter; the butter storage rooms, churns, refrigeration and ice-making plant are all placed on the same floor level; the latter is 5 to 6 feet below the platform on which the operations of receiving, testing, grading, weighing and treating of the cream prior to churning are carried out. Fig. No. 1 gives some idea of the general lay-out of the equipment and plant. This is a view of the interior of the creamery, showing churns in the foreground. The cream treatment plant, which is situated on the raised platform mentioned above, can be seen in the background. This arrangement permits of the delivery, by gravity, of cream to the churns after treatment on the top platform. This illustration also shows the convenient arrangement whereby cold water is delivered to the churns for washing the butter, etc. The pipes through which the water is carried are placed in front and slightly above the churns. The latter have a combined churning capacity of approximately one ton of butter—i.e., the two churns when working together at full churning capacity will turn out approximately one ton of butter at each churning. The packing, etc., of the butter is carried out on the same

floor level as that on which the churns are situated. After packing, the butter is placed in the cold storage rooms. The latter are maintained at as low a temperature as possible. As a rule, the temperature of the butter storage does not exceed 8 to 10 degrees F., and is usually lower.

The cream when delivered at the creamery is received on the top platform, where it is graded, weighed and sampled for testing. After it has been graded and weighed, the cream is sorted out according to grades and the cream treatment process then commences, each grade of cream being, of course, handled and treated separately.

The first stage in the process is the mixing, warming and neutralising of the cream. This is carried out in a large open vat known as a "forewarmer" or "preheater." The latter is fitted with an oscillating coil of pipes through which hot water is passed. Fig. 2 illustrates the type of forewarmer in use at the Salisbury Creamery. This forewarmer is constructed of stainless steel—a metal which is very resistant to acid corrosion; it is necessary that the forewarmer should be constructed of metal of this description, as most of the cream received is sour and has a high acid content. The cream is emptied from the cans into the vat, and is thoroughly mixed by means of the oscillating coil previously mentioned; the cream is at the same time warmed —or preheated, as it is termed—to a temperature of about 100 degrees F. to 110 degrees F. Whilst the cream is being mixed and heated, its acidity is reduced by the addition of alkaline substances such as lime or sodium bicarbonate, etc.

This neutralisation or reduction of the acidity in the cream is an essential part of the cream treatment process.

Acidity or sourness in cream has been proved to be antagonistic to keeping quality in butter, and for this reason it is necessary that the acidity in the cream should be reduced at this stage.

The second and perhaps the most important stage in the cream treatment process is the pasteurisation, de-gassing and cooling of the cream. The process of pasteurisation consists of heating the cream to comparatively high temperatures with the object of destroying any deteriorative organisms that may be present. De-gassing or deodorising

is, as the term implies, carried out with the object of removing undesirable odours or taints. After pasteurisation and deodorisation, the cream is cooled to churning temperatures.

All these operations are carried out by means of the apparatus illustrated in Fig. No. 3.

The cream is heated and cooled in the machine shown on the left of the illustration. This machine is known as a plate-heater or heat-exchanger, and is very ingeniously constructed of a series of plates which, when pressed or screwed tightly together, form a very compact rectangular-like box. The transfer of heat is effected by means of these plates, on one side of which passes the cream which has to be heated or cooled and on the other the heating or cooling medium which is used. The whole structure is divided into three sections. In one of these the cream is heated by means of hot water to a temperature of about 170 to 180 degrees F., in another the cream is cooled by means of cold water, and in the third section the cream is finally cooled to a low temperature by means of circulating brine. The entire machine can be very easily dismantled and the plates separated so as to permit of thorough cleaning. The plates through which the transfer of heat is effected are constructed of tinned gun metal; the other separating plates are constructed of stainless steel. This machine has a capacity of 400 gallons of cream per hour.

The de-gasser in which odours and taints are removed from the cream is also shown in Fig. No. 3. In appearance it resembles a cylindrical tank and contains a number of flat circular metal sheets placed one on top of the other. Deodorisation is accomplished by the maintenance of a partial vacuum inside the machine. Cream enters the latter from the top, and on entering is spread out in a thin layer over the flat plates previously mentioned. The vacuum which is maintained assists in removing taints and odours from the cream.

The sequence in which the above operations are carried out is as follows: The cream is pumped from the forewarmer to the heating section of the pasteuriser or heat-exchanger; from here the hot cream passes through the de-gasser, whence it is pumped back through the water and brine cooling sections of the heat-exchanger.

The apparatus described in the foregoing is most effective and is really quite simple in construction. It is of interest to note that this is the only plant of its kind in South Africa. It is also of British manufacture and was supplied by the Aluminium Plant & Vessel Company of Great Britain.

The final stage in the cream treatment process consists of holding the cream at churning temperature for several hours. This is a very important operation. The liquid portion of the cream cools much more rapidly than the butterfat which it contains, and in order therefore that the latter may be thoroughly chilled, it is necessary that the cream should be held at low temperature for a period of several hours—at least three to four hours—before churning. This is accomplished by means of the cylindrical vats shown in Fig. No. 4. The cream is pumped into these vats from the brine cooling section of the pasteuriser previously described. The three vats illustrated—one for each grade of cream—are constructed on the inside of glass-coated steel, and are therefore very hygienic and easily cleaned. These vats are insulated to prevent any rise in the temperature of the cream. They are also provided with a jacket through which cold brine can be circulated if necessary, and are fitted with an agitator for stirring the cream. These vats are of Australian manufacture, and each one has a capacity of 400 gallons.

This completes the cycle of operations involved in the treatment of cream prior to churning. After being held for several hours at churning temperature in the vats mentioned above, the cream is transferred to the churns, etc.

It must be evident from the foregoing that the commercial treatment and preparation of cream for conversion into butter is quite an elaborate and even complicated process. It is also evident, however, that in establishing and equipping the new creamery at Salisbury, full attention has been given to the various processes and operations involved in modern creamery practice.

This creamery is well equipped for the manufacture of butter for export overseas, and its progress in this direction will now be watched with great interest.

THE CONSTRUCTION OF DIPPING TANKS.

By B. G. Gundry, A.I.Mech.E.; and Notes on their Management, by J. M. Sinclair, M.R.C.V.S., Chief Veterinary Surgeon.

Since the building of a dipping tank is not likely to be attempted by a novice with no previous knowledge of building, it is not intended, in this article, to describe all the details of the operations involved, but rather to provide such particular information as will enable farmers or others with some experience of building in the materials they propose to use, either to perform this rather exceptional job themselves or to supervise the work of a native or European contractor.

Selection of Site.—Great care should be taken in selecting a suitable site for the erection of a dipping tank.

The site must be well drained and the soil firm and compact. A sand, gravel or schist formation is most desirable. Ground liable to become swampy or water-logged should be avoided. The ground should, if possible, have a slight uniform slope so that it is well drained and there is no difficulty in arranging that the floor of the dripping pen, which is placed at the higher end of the tank, may slope in the direction of the tank. If such a slope is not available the soil removed from the excavation should be used to build up the floor of the dripping pen to the proper height and slope.

A permanent supply of clean water from a river, borehole or well is necessary, and this supply should be definitely provided before work on the tank is commenced, especially if the sinking of a well or borehole is to be undertaken.

Materials.—Dipping tanks may be built of concrete, plain or reinforced, masonry or well burnt bricks.

In most cases there is some deciding factor which determines which of these materials can be most economically used on any particular site. Where good building stone, such as granite, dolorite or other crystalline igneous rock, is available, a masonry tank is probably the cheapest. If bricks are used they must be really sound and very well burnt. Lightly burnt and friable bricks are useless for this purpose.

Testing.—When a dip tank has been completed and filled for the first time it is not always an easy matter to decide whether it is sufficiently water-tight or not. During the first twenty-four hours after filling, the level of the water may fall by as much as three inches; this is due partly to evaporation, but chiefly to the absorption of the water by the concrete or plaster. If the tank is again filled to its full capacity the loss should be very considerably less during the subsequent twenty-four hours if the work is reasonably sound, and after three or four days there should be no loss apart from evaporation, which may vary from practically nothing in cool humid weather to as much as ¼ inch in twenty-four hours in hot dry windy weather. Any loss in excess of this amount will indicate a leakage either through a definite crack or through porous plaster or concrete. The remedy will depend on the nature of the defect. A coating of some bitumastic solution such as 1 lb. pitch to 1 gallon of tar boiled together and applied hot with a stiff brush or some proprietary solution made specially for such purpose may be found necessary in the event of the structure proving porous. Cracks will require special treatment according to their nature and extent.

Calibrating the Tank.—For the purpose of being able to adjust the strength of the dipping fluid from time to time, it is most important that the actual quantity of fluid in the tank can be readily determined. The most satisfactory method of calibrating a tank is to measure the water required to fill it by means of a small tank of known capacity of, say, 100 or 200 gallons.

When the level of the water in the tank has risen to about 5 feet—the quantity required to reach such a level having been carefully noted—a measuring stick, preferably a hard wood plank, about 10 ft. long, is stood vertically on

the bottom of the tank, and as each succeeding 100 gallons of water is added the new level is marked on the stick by means of a shallow saw cut, with the corresponding number of gallons marked against it by scratches or punch marks. This operation is continued until the tank is full. An alternative method is to first graduate the stick in feet and inches, and with this, measure and record the depth corresponding to each addition of water.

If the former method is used the marks on the stick should be measured and recorded in some safe place so that in the event of loss or damage to the stick itself a new one can be made. The full capacity of the tank as illustrated is 4,170 gallons.

The measuring tank is also used subsequently for proportioning the dip fluid when making up the dip to the proper strength or level.

The water should be pumped or delivered into the measuring tank and from there led into the dip tank by means of a pipe. The concentrated dip should be added separately and not be mixed in the measuring tank unless it is constructed of some non-corrosive material.

Roof.—The provision of a roof over the dip tank is strongly advocated, as it diminishes considerably the variation of the strength of the fluid by evaporation or the addition of rainwater. An ordinary pole and thatch roof is all that is actually necessary, but a more permanent and neater roof can be constructed of corrugated iron as shown in Fig. I. The iron can be obtained rolled to any curvature at a small extra cost, and the minimum amount of imported timber is required.

In the drawing a distance of 6 ft. is allowed between the ledge of the tank and the beams of the roof, but if this amount of head room is considered unnecessary, the height of the roof may be decreased accordingly.

Dripping and Collecting Pens.—The provision of a properly constructed dripping pen is essential in order to save a very big loss of dipping fluid. A triangular pen immediately adjacent to the outlet of the tank is strongly recommended in preference to the long paved "walk" sometimes advocated.

The floor of the pen should be of concrete or stone; ordinary farm-made bricks will not stand up to the work by themselves, and the amount of cement required to plaster them sufficiently thickly to make them serviceable would be better employed in the making of a true concrete floor. The stones in a masonry floor should be flat and as large as possible up to 2 or 3 square feet in area. They should be carefully bedded down with a space of about ½ in. between adjacent stones. These spaces are afterwards filled in with a grouting mixture of 1 part cement and 5 parts sand. The edges of the stones should first be cleaned and the ground beneath moistened by pouring water into the joints. The grout must then be thoroughly worked in with a small trowel. The floor should have an even surface and slope down from the three sides towards the tank with a fall of at least 1 in 50 so that the drippings from the cattle will flow back to the tank fairly rapidly. If the pen is to be enclosed by a fence only, a low kerb should surround the floor.

Where plenty of stone is available a heavy masonry wall is the best method of enclosing the dripping pen, particularly in cold and windy situations, as it affords some protection to the cattle and it is also more permanent than a wooden fence. The stones may be laid in lime mortar or even dagga, in which case the joints should be raked out to a depth of at least 1 in., wetted, and pointed with 1 to 4 cement mortar. In either case the top of the wall should be finished off with a cement plaster capping to prevent rain entering the joints. Such a wall should be about 2 ft. wide at its base and 1 ft. wide at the top, and 4 ft. 6 ins. high. An example of "squared rubble" masonry is illustrated in Fig. II. This type of bond is recommended as being far stronger than "random rubble," which too often becomes a mere pile of stones, having neither strength nor stability. The size of the dripping pen will depend on the size and number of cattle which have to be dipped in a day. A fair average allowance is 12 square feet per head. When large herds have to be handled considerable economy in time can be effected by erecting a central fence to divide the pen into two halves, and a gate or slip rails are arranged as shown in Fig. I. This arrangement allows the animals in one half of the pen to drip while the other half is being filled, when the first batch is released and so on.

A small gulley must be made between the top of the outslope of the tank and the dripping pen. An iron pipe should be set in the wall of the tank to carry rain water which falls in the dripping pen from this gulley, clear of the tank. The diameter of this pipe should be proportionate to the size of the dripping pen; a 3 in. pipe will be sufficient for the size of pen shown in the drawing. A second pipe is set to lead the fluid returning from the dripping pen back into the tank. When dipping is in progress this pipe is left open and the rain water pipe closed; at other times conditions are reversed, the rain water pipe only being left open. A stick or piece of sacking is sometimes used to close these pipes, with the result that they are apt to become accidentally stopped up. A better plan is to fit a screwed socket to the end of each pipe in which a standard screwed plug can be used as a stopper.

The step or ridge between this gulley and the tank should be at least 7 ins. high to ensure that during a heavy storm the rain water does not overflow into the tank.

The collecting pen can be of any desired size according to circumstances, and may be fenced with stout posts or rails, or surrounded by a masonry wall.

It is advisable to fence off the entire site of the dip to prevent stray animals from licking any dried arsenic which is always liable to accumulate round a dip in sufficient quantities to prove extremely dangerous.

It is also advisable to provide a trough from which the cattle may drink before being dipped, as thirsty animals may attempt to drink the dipping fluid as they pass through.

Cement Mixtures.—Since the use of cement enters largely into the construction of all the dipping tanks described herein, a general summary of the more important points to be observed in its use is given here, as they apply with equal importance to all cement mixtures referred to subsequently, but for more complete information the reader is referred to Bulletin No. 588, "Concrete on the Farm."

The cement itself should be obtained as fresh as possible; it deteriorates on keeping over-long even in a comparatively dry store.

Only clean, sharp sand should be used with cement. It should be fairly coarse and must be free from organic matter, earth, clay and dust. Such impurities, if unavoidably present, must be removed by washing the sand.

The aggregate for concrete must consist of hard, clean, angular stone such as granite, quartz, quartzite or diorite; all oxidised or soft pieces must be discarded. Sandstones and shales must not be used.

The stone must be broken down to various sizes, varying from the maximum size specified for the particular job down to quite small pieces.

All water used must be clean and free from excessive quantities of dissolved impurities.

All cement mixtures, by which is meant mortars, plasters and concrete, should be carefully proportioned by means of suitable measuring boxes or tins. Careless measuring must result either in a weak mixture or a waste of cement.

The mixing must be carried out on an impervious platform of wood or iron, free from cracks and holes through which the cement can run to waste, or on a brick floor laid on a level piece of ground and grouted with a mixture of 1 part cement to 6 parts sand.

The mixing must be carried out systematically. The sand should be measured out and spread in a thin layer, over which the cement is then sprinkled. These should be mixed thoroughly while dry by being turned completely over from one end of the platform to the other at least twice, and the mixing board should be sufficiently large to permit this to be done.

In making concrete the aggregate may be added dry and mixed at the same time with the cement and sand, or it may first be wetted and added to the cement and sand after they have been already mixed, in which case the water must be added to the whole and the mixing be proceeded with immediately.

The water should be added gradually as the mixing proceeds, by means of a watering can fitted with a fine rose, and care should be taken not to add too much water towards the end of the operation, as it will be found that at this stage

the mixture appears to become much more moist by the continued action of mixing alone, owing to the better distribution of the water. Only sufficient water should be added to make the mixture workable; any excess of water decreases the eventual strength of the mixture.

The mixing of cement should never be left to unsupervised natives; sooner or later they will "let you down" in one way or another.

The setting of cement, which is a chemical reaction, commences very shortly after it becomes moistened, and the longer it is worked after setting has commenced, the weaker the final product will be. It follows, therefore, that the mixing and placing of the mixture should be completed as quickly as possible. Each batch should be placed and left undisturbed within 30 minutes from the time the water is first added to the mixture, and the sizes of the batches should be limited to enable this to be done.

Plastering should be done quickly and continuously. Native builders are inclined to spend much too long attempting to obtain a good finish, thus imperilling the durability of the plaster.

Any surface which is to be plastered must be washed or brushed free of all dust and loose particles, and wetted before the plaster is applied.

Immediately cement work has set it must be protected from the drying action of wind and sun by being covered with sacks or grass, which must be kept wet continuously for at least seven days. This process, known as "curing," is absolutely essential if satisfactory results are to be obtained.

In order to render cement mixtures (particularly plaster, mortar and grout) less harsh to work, a proportion of lime paste is sometimes added. Not only does it make the mixture more workable, but renders it more waterproof. The lime paste is prepared by soaking quick lime in water for at least two weeks, and then straining it through a fine sieve to remove any solid particles which may not have decomposed and which, if included in the plaster, may burst out and ruin the job. The lime paste is mixed to a thin cream and added to the other ingredients with the first mixing water.

There are numerous special preparations on the market for adding to cement mixtures in order to render them waterproof, and their use can be recommended especially for the plastering of the inside of the tank itself, where added security is considered desirable. The special instructions supplied by the makers should be carefully followed.

A Concrete Dipping Tank (Fig. I.)—Construction.—The excavation for the tank must be taken out to the neat dimensions shown in the drawing. Particular care must be taken to see that the shelf for the side walls is cut down until the formation is thoroughly compact.

The bottom and outslope should be tamped all over to ensure that there are no soft spots. The formation should be uniform throughout; should there be any variation there is a danger of uneven settlement and consequent cracking of the concrete.

The concrete used throughout should consist of 1 part cement, 3 parts sand and 6 parts aggregate. For the floor and thinner parts of the walls the aggregate must be crushed to pass a 1 in. diameter ring, and, for the heavier section, a 1½ in. ring.

The floor and outslope should be laid first over the whole width of the excavation. Particular care should be taken in laying the outslope to ensure that the concrete is absolutely solid and water-tight. It may be found advisable to reduce the quantity of stone to 5 or even 4 parts if any difficulty is experienced in this respect.

The steps must be moulded as the work proceeds, and not stuck on afterwards. When this work is completed, the form work for the walls may be erected. This will consist of "V"-shaped frames constructed of 3 in. x 2 in. timber, which must be carefully aligned and held rigid by cross pieces extending well beyond the sides of the excavation and secured to pegs driven into the ground.

The actual forms should consist of 9 in. x 1½ in. planks planed smooth on their inner face and placed 3 or 4 deep all round.

The legs of the "V"-shaped frames should be held apart at the bottom by loose wedges so that when these are removed

the planks are freed and can be raised without damaging the concrete.

The concrete must be laid in continuous layers not exceeding 12 ins. in thickness extending all round the tank. Two such layers at least should be completed each succeeding day until the level of the ledge is reached. All materials should be ready at hand so that the work of laying the concrete and applying the plaster can be completed in the shortest possible time.

It will be found that a scum of impurities forms on the surface of each layer of concrete as it sets. This must be scraped off until a clean rough surface of stone and sand is exposed. This surface should be given a thin wash of 1 part cement and 1 part sand immediately before the new concrete is placed above it.

As soon as the final layer is sufficiently set, the form work should be removed and the interior surface of the concrete roughened where necessary with some sharp steel implement preparatory to plastering. The plaster, which must be applied in a single coat not less than ½ in. thick, should consist of a mixture of 1 part cement, 3 parts sand and ½ part lime paste—prepared as directed under the heading of "Cement Mixtures." The surface of the walls must be thoroughly wetted before the plaster is applied, and every effort should be made to complete the plastering in one day. A smooth surface should be obtained by a final polish with a steel float, but this process must not be overdone, or fine hair cracks may develop. When finished, it must be cured as previously described for at least seven days.

The placing of the concrete walls above the ledge can now be proceeded with. Whether these walls are afterwards plastered or left more or less rough is a matter of personal choice. A plaster consisting of 1 part cement, 5 parts sand and ½ part lime paste will be found suitable for the purpose, but the surface must be first roughened and wetted as previously described.

The tank may be filled as soon as convenient after the internal plastering is sufficiently set.

Concrete Dipping Tank: Quantities of Materials.

Item.	Section.	Length.	No. Of.	Total Quantity.
Cement	—	—	—	132 bags
Sand	—	—	—	30 cu. yds.
Stone	—	—	—	54 cu. yds.
Lime	—	—	—	3 bags
Roof:				
Bearers	4½ in. x 3 in.	14 ft.	4	56 ft.
Bearers	,,	14 ft.	2	28ft.
Tie beams	,,	8 ft.	7	56 ft.
Corrugated iron	24 G.	12 ft.	22	264 ft.
Roofing screws	—	2½ in.	—	1 gross

The above quantities of cement include sufficient for the pillars supporting the roof, but if these are not required, the quantity can be reduced by three bags. If the walls above the ledge are to be plastered—both inside and outside—a further five bags will be required. Sufficient lime is provided for all plastering.

Those who have had sufficient previous experience in this class of work may prefer to adopt what is really a sounder method of construction, but which requires more skill and judgment; that is, to cast the concrete below fluid level so that it is sufficiently compact and dense that plastering is unnecessary. This may be achieved by making the following modifications: The concrete mixture should be 1 part cement, 3 parts sand and 5 parts stone and ½ part lime paste. The aggregate must be very evenly graded, and special care must be taken in punning the concrete as it is laid, and to obtain a smooth surface it should be spaded away from the shuttering. This mixture will, of course, require a larger proportion of cement, but this can be balanced by reducing the thickness of the walls below fluid level at the discretion of the builder.

Particulars of a masonry and a brick dipping tank will appear in our next issue.

SOME PROBLEMS OF INTENSIVE FARMING WITH MECHANISED EQUIPMENT.

By A. J. Hosier.

Reproduced from "Increased Production in Agriculture." (Published by the Institute for Research in Agricultural Engineering, University of Oxford.)

Mechanised farming is a term widely used to-day. What does it mean? It means applying organised mechanical science to agriculture. For years past we have seen tremendous strides with mechanical science in other industries, and out of it has evolved a scientific mass production of commodities out of all proportion to the distributive or consumptive demands. In the big factories we see an army of machine minders, one man doing the work done by many a few years ago, and this has led to a large surplus of commodities. In spite of this surplus mechanical scientists are still bending their energies to producing more.

If the economists of the world had, during the last decade, made as much progress in economics, they would now be able to show us how to distribute and consume as fast as we can produce. It is the balance that we need, and until the spending power of the world is increased, we shall be in the Slough of Despond. Nearly everybody is preaching and practising economy to-day, but why should the world economise if there is a superabundance of everything? Economy will only accelerate and increase surpluses. Why cannot a way be found to consume as fast as we can produce? Years ago, when there was a shortage of commodities, it was wise to economise; to-day it would be wise to be extravagant if it were done universally.

If, by some calamity, all the world's surplus were destroyed to-day, to-morrow the world would be temporarily cured of her malady. Industry and agriculture would again be flourishing, and everyone would be working to produce something that was required; not a surplus. It should not be beyond the wit of man to devise a scheme to cure the world malady, and until that time it will be the survival of the fittest.

I have been doing pioneer work in agriculture for a good many years, and believe me, a pioneer's path is not a path of roses. There is no system to follow; one has to think out every step of the way. To ask a fellow agriculturist's opinion on a new scheme is simply to invite the pouring of cold water on it. If one fails, there is no experimental fund to draw upon, but if one's efforts are crowned with success then the benefits are passed on.

Some 12 or 13 years ago I came to the conclusion that my system of farming would soon come to a parting of the ways. I was purely arable farming from 1914 to 1920, selling off hay, straw and corn, and fertilising with artificials, and I rented my holding. My view was that hay, straw and oats would not be saleable products, because the roads and the Army were mechanising, and therefore I must change my system, viz., to consume on the farm all hay, straw and cereals. I decided that milk production for the liquid market would be the best and safest proposition, because of the sheltered market, but my problem was that I had a poor hill sheep farm, practically without buildings, and composed of arable and downland, with no pastures, and, worse still, it was unfenced and unwatered.

During 1920 and 1921 I grassed down every acre of arable, most of it in a foul condition; I fenced off the fields with barbed wire, set about the problem of laying on water, and, in 1922, commenced my open-air milking system.

I want you to picture the difficulties I had to face to make it a dairy farm. Not an acre of cow pasture, no water, no fences, no buildings, and to-day people tell me that Wexcombe is ideally adapted for my job. I know it is, but I adapted it. If I had not conceived the idea of a moving cowshed, dairying would have been impossible, and at that

time hand labour for milking was out of the question. My ambition was to mechanise my milking, and to milk the cows where they were pastured. This method would also short-circuit some of the indirect work such as manure carting: no manure carting would be necessary. Another great advantage would be that the hay and ensilage could be consumed where it grew.

I have at the present time seven herds of about 65 cows each. These herds are each managed by a man and a boy. In winter they have enough work to keep them employed between milkings, and in summer they are available between milkings for haymaking. Each unit is independent. As fast as I have land available I can increase my units of 65 cows. The only limiting factors are (1) available land, (2) capital, (3) a market for the milk. My total labour costs are 1d. per gallon. My milk yields per cow range from 610 to 725 gallons per annum, and my depreciation on the herds is nil; therefore my position as a milk producer is unassailable. I ought to explain why we suffer *no* depreciation on the herds. (1) Owing to healthy conditions, (2) I do not wear my cows out; I sell them approximately with their third calf, when they are at their best. This method *may* depress the milk yield, but I get no depreciation.

Although I am having a good output per acre on these mass production lines, with little labour, I can still see ways and means of doubling my output per acre, and that is by what I call mechanised poultry farming. I am now running laying hens on the same lines as the cows. I find that a man and a boy can, with my folding system, look after 4,000 birds. I have designed a combined house and run to hold 25 birds, and have 160 of these houses on about 25 acres. The man and boy move the houses daily, feed the hens and collect the eggs; there is no cleaning out and all manure is evenly dropped on the land—a great asset. Each house being moved daily covers approximately one acre of land per annum.

The improvement to the pastures, first by the movable milking plant, and secondly by the poultry folding pen, is amazing. The keeping of 4,000 fowls on the pastures set apart for one of the 65 cow units does not lessen the cow keeping capacity, and the gross output from the hens is

greater than from the cows. By adding a unit of 4,000 hens with a unit of dairy cows, I am in a position to produce eggs cheaper than ordinary poultry farmers.

Most of my land was originally arable, and, after being worked with eggs and milk for a few years, will need only the bees to make it a "Land flowing with milk and honey."

In future years, why cannot I break up this highly fertilised land into sections, and cash the fertility with sale crops if markets improve? The land has been manured free for years, and has become wonderfully clean. I have broken up two or three pieces of the land referred to, and have had splendid results.

The man who mechanises his farm for cereal growing only cannot get very large average returns, probably not more than one-third of the amount from the system described above.

From a national point of view it is of the utmost importance to reduce the value of our imports. The safest way to achieve this object is to produce more milk, meat, bacon and eggs.

Haymaking.—For years I have been chafing against the laborious and time-wasting methods of haymaking. The more hand labour we put into the making of hay the better we used to think the hay was. I have a brother who used to consider that his hay was better than mine because he had all his grass cut with a scythe, and all operations were done by hand, whereas mine were done with machines. He was very surprised when he found that I sold the hay at as good a price as his "specially made" hay. It is very interesting to note the various steps in improving the methods of carting hay during the last 35 years. In our own locality we used to pitch all hay on to a wagon, then the hay-loader was adopted, then the hay-sweeps. I consider it folly to keep handling the hay, pitching it from one place to another. My system of haymaking is interwoven with the milking system, and is mechanised almost completely. For my cows it is not necessary to cart hay long distances: it is ricked on the fields where it grows, and that is where it will be fed to the cows. I frequently cut and cart hay without horses at all, but as yet I have not been able to economise by dispensing with horses

for raking. For the past two seasons we have swept all our hay in to the stacker (or elevator) with a sweep attachment to the front of cars. Old cars are very cheap to buy, and even if you use your best driving car, it will not damage it. This is what I call haymaking in luxury. We have a stacker at the rick, two drivers each with a car and sweep, and about every two minutes in comes a load, which is pushed on to the stacker, and a third old car—or horse if you like—lifts the sweep load and throws it half way over the rick, so that the only laborious work we have is for the couple or three men on the rick. With this gang there is no difficulty in stacking 30 tons daily. The sweep I have designed for a motor car has some special features: (1) The points are eccentric; (2) it has no wheels; (3) it is carried on the dumb irons of the car; (4) it is reversible, i.e., can be turned upside down, thus bringing the points nearer to or farther from the ground as desired.

Ensilage.—The weather in the summer is so uncertain for making hay, and if the hay is spoiled we cannot get good yields of milk, and the cattle lose their condition. It is generally accepted that there is nothing like June grass for a milch cow or grazing bullock, and it has often occurred to me that if we could preserve the June grass with all its nutriment, what a valuable food it would be for winter feeding. Concentrates could be cut right out and our farmers would be more self-supporting and depend less on foreign high protein foods. Another very important point is that, with ensilage, we are not dependent upon fine weather. With ensilage we do not risk losing the leaf as we often do with hay and we have a luscious and juicy fodder which is ideally adapted for open-air feeding. It is not blown about like hay on a windy day and is not so easily spoilt, or so easily damaged by rain when being fed to the cattle. We are already preserving June grass in various ways: some in the tower silo, some in pits, and others of us are making stack ensilage. The snag is that, by whichever method we adopt, there is a serious loss of the most valuable constituents; also it has been a most expensive job to collect and stack. The cost of collecting and stacking I have reduced to a minimum, and I think we are within reach of success as regards preventing any chemical loss. The Imperial Chemical Industries, Ltd., are doing some

very valuable work in this direction which will, I believe, bear fruit. I believe ensilage, as we are at preesnt making it, is a very valuable adjunct to the menu of our cattle. I make several hundreds of acres every year, and I will describe the process, which may appeal to many of you. It is made from either meadow or temporary grasses, also from forage crops, such as peas and oats. When making ensilage from grass, I cut the grass as young as possible and sweep it into the stack immediately with my car sweeps, and it is built into a round stack on the site, using a stacker or an elevator. It is very necessary when cutting the grass not to allow a horse or tractor to travel on the swath, as this will prevent the sweep from getting under the cut grass. The sweep, having eccentric points, should have the points close to the ground. I do this by turning it upside down. Then I follow the mower, taking two swaths at a time, and drive the grass up into heaps as fast as it is cut. The other sweep will then collect the heaps and take them in to the stack. In this way I can gather 20 to 25 acres daily. In order to prevent any horses treading on the swath, I have fixed a "Douglas" motor cycle engine on the horse mower to drive the knife, first removing the internal gearing. By this means I am able to use one horse only on a 6 ft. mower, and this horse walks in the track made by the swath board. I have described the procedure in detail, as each point is important. This equipment I can keep going almost daily, whatever the weather, and after the main crop I run over all my cow pastures, clearing off the rough and strong patches, and collecting into stacks. It is surprising what good and useful fodder this is, and the pastures are kept sweet. For our large scale operations we find the stack ensilage the best proposition. When we get a flush of autumn grass, we are frequently making ensilage through October and sometimes into November. When collecting very short grass I find it necessary to fit double tines to my sweep.

I have given so much of my paper to dairying, haymaking and ensilage that I have not time to describe how I handle my 800 acres of arable land, but I would say that it is subservient to my dairying and, if cereal prices are low, I feed cereals to my cows and poultry.

PRODUCTION AND MAINTENANCE OF TURF ON LAWNS, BOWLING AND GOLF GREENS.

By S. D. Timson, M.C., Dip.Agric.(Wye).

PART I. PRODUCTION.

Many requests for advice concerning the establishing and maintenance of grass lawns and greens for ornamental and for bowling and golf have been received by this Department, and it is hoped that the following notes on the subject may be of assistance to those who contemplate such undertakings, or who wish to improve their existing grass.

The production of sporting turf with a fine even texture and capable of withstanding the hard wear incident to the playing of games such as golf, bowls, football, etc., is a very different problem from that confronting the agriculturist who wishes to produce a heavy crop of hay or a lush pasture. The latter problem has received many years of close scientific study, whilst a wealth of literature embodying the experience and knowledge gained is available for the assistance of those studying the problem. On the other hand, it is only during the past twelve years that any scientific attention has been directed to the question of the production of sports turf, or that any authoritative literature on the subject has become available. And yet a very large sum of money is being spent annually on the production and maintenance of such turf, and very much larger sums are invested in the various games such as football, cricket, tennis and golf, which require fine turf as their proper medium.

Formerly the groundsmen and green-keepers in charge of sports grounds and golf courses had to serve a long apprenticeship before they could gather the knowledge necessary to enable them to produce satisfactory turf, and

they were as a rule only able to do this under one set of conditions. Since the Great War, however, Dr. Murray in the Union of South Africa, the United States Golf Association in America, and the St. Ives Research Station in England established by the British Golf Unions, have directed a scientific study to the subject, and much light has been thrown on the question of the proper treatment of grass for sporting purposes, particularly with regard to the correct fertilisers to employ.

PREPARATION OF THE SITE.

Proper Time to do the Work.—The preparation of the site should be done in the autumn or winter, so that the planting of the grass can be carried out in the spring.

Levelling.—In the case of bowling greens, a dead level surface is required; ornamental lawns also require usually to be more or less level. In the case of golf greens, a dead level surface is not required, but owing to the severe erosion caused by the heavy rains experienced in this Colony, and owing to the extreme drying and scorching caused by the sun, no abrupt prominences or slopes on a golf green are advisable. Therefore, here too it may be necessary to do a certain amount of levelling of the surface before the grass is planted.

Danger of Sub-soil.—If any extensive levelling operations are to be carried out, the surface soil to a depth of six to nine inches should first be carefully removed and placed aside, care being taken that none of the sub-soil, which is usually easily distinguished by a difference in colour, is lifted with it. The sub-soils lying under the red and chocolate clay loams of this country are almost invariably at first unproductive for crops and turf owing to their rawness and the lack of humus and available plant food. If mixed with the surface soil in any quantity, the sub-soil usually exerts what may be termed a severe "poisoning" effect on all vegetation, which it may take a number of years of weathering and treatment to abate. It is necessary, therefore, strongly to emphasise the danger that lies in the use of sub-soil, or a mixture of sub-soil in any quantity with the top soil.

After the removal of the top soil, the surface of the site should be levelled, or, in the case of a golf green, the surface should be modelled to give the required slopes.

Trenching.—If there is any doubt as to the drainage of the sub-soil, the whole area should now be deeply trenched to a depth of nine to twelve inches. If poor drainage conditions are known to exist, they may be improved by placing a layer of stones at the bottom during the trenching operations, or by the use of tile drains. Good drainage is essential to a healthy growth of turf. After the trenching is completed, the top soil is replaced evenly over the whole surface. Large stones can be removed from the top soil before replacing it by the use of screens. A half to three-quarter inch screen is sufficiently fine.

Where a dead level surface is required, this can be approximated at this stage by the use of pegs and a level. The final levelling is done after the grass has made fair growth as is mentioned later.

Type of Soil Required.—The type of soil best suited to the growth of fine quality turf is a fertile fine sandy loam, with a small proportion of clay and a good supply of humus. It will be seen, therefore, that few of the soil types in this Colony are really suitable, since the red or chocolate clay loams contain far too much clay and the sandy soils are generally too deficient in humus. However, the clay loams can be modified by the addition of good sandy top soil and well-rotted kraal or farmyard manure or leaf mould. If it is financially possible, at least an equal quantity of good light sandy soil should be mixed with the top soil. A heavy dressing of old, well-rotted kraal or farmyard manure or/and leaf mould should then be spread on the surface and forked in to mix it with the top six inches of soil. Up to one or two medium-sized scotch cart loads of manure or manure and leaf mould may be beneficially used per 100 square yards of surface. The heavier the soil the more farm manure is required, as its chief function is to lighten the soil and render it porous and at the same time retentive of moisture. These are the chief functions of the humus which the manure and leaf mould supply. If sand or sandy soil cannot be carted and mixed with the heavy top soil, then heavier

dressings of manure are desirable. It should be borne in mind at this stage that once the grass is planted the soil cannot be cultivated effectively, nor can anything be done to alter the physical condition to any material extent, except for the top inch or so perhaps. For this reason, if the best quality of turf is desired, it is necessary to carry out at this stage any modifications of the soil that may be required.

It is, of course, possible over a period of years gradually to build up a suitable medium above the existing soil by continual top dressings, but the turf will always suffer from the physical deficiencies of the original soil existing below, especially where this is of the heavy, impervious type; moreover, it is a very slow process.

Where the soil is known to be infertile and unsuited to produce good turf, the top six to eight inches of soil should be removed and replaced by good soil. This will be cheaper and more satisfactory and yield results more rapidly than attempts to improve the existing soil. If the natural soil is a very fine light sand, it may be given more "body" by the addition of a proportion of good clay loam soil, but care should be taken not to add too much. It is better to have a soil too light than too heavy.

The green or lawn should now be allowed to settle down until after soaking rains have fallen. It will probably be found necessary to level the surface again owing to the soil sinking unevenly, and also probably to eradicate one or more incipient growths of weeds.

PLANTING.

Types of Grass.—The fine grasses found most suitable for turf under local conditions are all types of couch included under the botanical genus *Cynodon*. There are said to be over two thousand different varieties of couch grass existing throughout the world, and there are many different species and strains in this country and the Union of South Africa, some of them varying from one another only slightly.

To withstand local conditions, it is necessary that the type chosen should be deep-rooting and so drought-resistant, requiring a minimum of assistance by artificial watering. It is a fairly general rule that the power of rapid spreading is

closely allied to a shallow root system and vice versa, and in choosing between two similar types it will usually be found that the more slowly spreading type is the deeper rooted and therefore hardier.

Another easily seen character which appears to be allied to hardiness is the smoothness of the leaves or their freedom from hairs. The very hairy types should be avoided.

Common or Bermuda Couch (*Cynodon dactylon*).—The common couch of the country is the Bermuda couch, which is comparatively hairless (hairs, when present, on the upper surface only), blue-green in colour and very deep-rooting. Its colour varies from light blue-green to deep green, according to local conditions. The flower-head usually has four to five spikes or branches, but may have from three up to eight. It is found all over the countryside, but particularly where intensive grazing has taken place as on the outspans, and on farms on the sand veld, and elsewhere where sheep follow cattle on the pastures. Under very favourable conditions and when not grazed it may grow eighteen inches or more in height, but under close grazing or cutting it forms a dense short turf.

It is the hardiest variety of couch at present known in this country, and is the most suitable for garden lawns where the water supply and the attention it will receive are limited and the finest type of turf is not required. It is a type which can be strongly recommended for this purpose, as it needs little water and makes early growth in spring and late growth in autumn.

The one objection to its use for lawns is that it is aggressive, and considerable attention is required to keep it out of flower beds and from the pathways.

The Hairy Couch (*Cynodon hirsutus*).—This is the other common type of this country. The leaves are hairy on both sides, and the flowering heads have four to five spikes. In close-cut turf the flowering heads are usually flattened to the ground and not erect.

This species is not at all hardy and is subject to attack by nematode. It is not recommended for lawns or greens.

Bradley Grass (*Cynodon bradleyi*).—This is one of the finest lawn grasses, but it is not recommended for use, since it is a weak grass and will not withstand drought. It is comparatively shallow-rooting and its root system is liable to attack by nematode, in which case the only remedy is to grub it out and re-plant with another type. It needs more watering than any other fine couch tried in this Colony. The leaves are hairy and the flowering heads usually have three to four spikes, though occasionally only two are found.

Germiston or Florida Grass (*Cynodon transvaalensis*).—This is a hardier type than Bradley grass and has been largely used in the Union of South Africa, but has not met with equal success in Rhodesia. It is a fine grass, of a bright yellowish-green colour, with leaves more or less hairy all over, the flowering heads having one to three, but usually only two, spikes. Fairly deep-rooting and moderately hardy, it is superior in both respects to Bradley grass. For putting and bowling greens it exhibits an objectionable "nap" unless very closely mown. For grass borders to paths and flower beds it is very suitable, as it is not aggressive and does not require constant trimming.

Harrismith Grass.—This is a type of fine couch slightly coarser than Florida grass, which has only recently been imported from the Union of South Africa into this country by the Royal Salisbury Golf Club and is still under trial. It has been used with success on the high veld in the Union of South Africa for putting and bowling greens, but suffers from the objection of "nap." It is hardy, having a deep root system.

It is bright yellow-green in colour, its leaves being more or less finely hairy. The flowering heads have one to three spikes, but usually only two. In fact, it appears to be a strain very closely allied, if not identical with, Germiston grass, though somewhat deeper rooted and hardier. It promises to be of use as a lawn grass, though it is not possible at present to say whether it will be really satisfactory for bowling and putting greens. It appears to be somewhat slow in its recovery from the winter rest.

Magennis Grass.—This is another type of fine couch recently introduced from the Union and under trial by the Salisbury and Raylton Bowling Clubs, and also by the Royal Salisbury Golf Club. As a bowling green grass, it has given good results, providing an excellent surface and proving hardy, though not so hardy as Bermuda couch. It can be recommended as a lawn grass where good treatment and care can be given, and should prove suitable for putting greens. It is said that it does not suffer so much from the objection of "nap" as Harrismith grass.

Magennis grass has a more pleasing, dark-green colour than Harrismith grass, which is apt to have a light yellowish-green colour where it does not receive ample supplies of nitrogen. It is a more rapid grower than Harrismith or Florida, and is said to recover more rapidly from the winter resting period. The flowering head has two to four spikes, and most commonly three.

Other Grasses under Trial.—A number of other varieties of couch grass are under trial at the Agricultural Experiment Station, Salisbury, including three varieties kindly supplied by Dr. Murray from Capetown, but nothing can be said at present regarding their suitability.

Kikuyu Grass (*Pennisetum clandestinium*).—This grass is used to a considerable extent in the Union of South Africa as a lawn grass, but it forms a very coarse turf, is very aggressive and requires rich soil and heavy feeding and watering. It has not done well in Rhodesia and is not recommended for lawn purposes in this country. Bermuda couch is always preferable, as it is hardier, much finer and needs less care and attention.

Confusion of Types.—Much confusion exists regarding the different types of fine couch, Bradley grass often being called Florida and vice versa, and so on. For this reason, the writer has given above a few of the main characters by which each grass is distinguished, so that the grosser errors may be avoided.

To sum up, Bermuda couch should be used for all lawns where a very fine grass is not required. For finer lawn turf or for bowling greens and golf greens, Magennis grass or

Harrismith grass may be used, with the balance of actual evidence rather in favour of Magennis grass.

Bradley grass, Hairy couch and Kikuyu are not recommended, the first two because of their delicacy and of the danger of nematode infestation, and the latter because it is too coarse and requires too much feeding and attention.

Although he has not yet seen it carried into practice, the writer is of opinion that Bermuda couch, if properly treated, and in particular if regularly dressed with the ammonium sulphate and iron sulphate mixture recommended below, will be found after perhaps two seasons to fine down sufficiently to form a good putting surface and one which should withstand wear better than the finer grasses.

Planting the Green or Lawn.—All the above-mentioned grasses must be propagated from "roots" or sods, since growth from seed is extremely slow and unsatisfactory, and in most cases seed is not obtainable.

Planting with sods of turf is not so satisfactory as the use of "roots" or runners, and is seldom possible owing to the absence of supplies. One great objection to the method is that, unless special nurseries of turf have been laid down, it is almost invariably found that other grasses are introduced as impurities. A tufted green takes much longer to become true for bowling or putting than one planted from "roots" or runners.

If sods are used, they should be thin, not thicker than one inch, and preferably half to three-quarter inch thick.

Planting "Roots" or Stolons.—The planting of "roots" should not commence until soaking rains have fallen and the subsequent settling of the soil has been corrected by re-levelling. Furthermore, it is better to leave the lifting or purchase of "roots" until strong growth has taken place. If dormant "roots" are planted, the subsequent growth will never be so rapid or satisfactory.

Quantity of "Roots" Required.—One bag of Florida or Magennis grass "roots," if planted at a spacing of six to eight inches between the rows and in continuous rows, should cover an area of about two hundred and fifty square

feet. One bag of Bermuda grass "roots" planted at the same spacing will cover a rather smaller area of ground.

The actual time of planting should be chosen, if possible, to coincide with a period of rainy, overcast weather, but if plenty of water can be used for watering, this is not so important.

It is not as a rule advisable to start planting before mid December. This will allow the site to settle and the grass to commence strong growth before the "roots" are lifted. Between mid December and mid January is the best period for planting, but planting can be done both earlier and later if a plentiful supply of water is available; if planted later, sufficient growing time may not be left to form a close turf.

The "roots" or stolons are planted in shallow furrows three to four inches deep and the soil lightly firmed over them. The closer the rows the quicker will the grass cover the surface, and with late planting and no water laid on the spacing must be close—even three to four inches is not too close in these circumstances—in order that the grass may form a complete cover before the end of the growing season. Where water is laid on, the growing season can be extended well into the autumn, and so wider spacing can be adopted with consequent economy of roots. If the surface is not covered properly before the resting period arrives, then the cost of hand weeding will be increased materially.

With a wide spacing of eight to twelve inches, however, the first weeding can be done by hoe and a big saving in labour cost is achieved and economy of "roots."

Where large areas are to be planted, as in the case of a new golf course, the spacing between the rows may be wide to start with and gradually decreased as the planting becomes later.

Where conditions permit and a large acreage is to be planted, grass nurseries should be established where the supply of "roots" for future planting may be grown, since the purchase of "roots" means a large outlay of capital.

After Planting.—Except on heavy soils which have not been lightened as advised above, the surface may be lightly

rolled, with the ordinary size of light garden roller, so as to compact the soil round the "roots."

First Top Dressing and Fertiliser.—As soon as the runners commence to spread across the rows, the weeds should be hoed out (where the wider spacings are employed) or be removed by hand. The first top dressing and fertiliser should be applied now, as this will serve to stimulate the growth of the grass, conserve moisture by forming a mulch, and provide a thin covering of loose soil in which the runners can root down readily.

About fifteen to twenty lbs. of sulphate of ammonia should be mixed with one cubic yard of soil, and this will cover an area of about seven hundred square yards—the size of an average golf green. Only a thin covering on the surface is required, which should not cover the growing grass.

If preferred, the fertiliser can be spread separately at the rate of one hundred to one hundred and fifty lbs. per acre after the top dressing is applied, but it is better to mix it with the compost, as a more even distribution is thus obtained.

The composition of the top dressing or compost is discussed later.

When the runners have joined up across the rows and become interlaced, the green or lawn should be rolled again and then cut. The mower should be set sufficiently high above the ground to avoid any possibility of damaging the runners.

After mowing, the weeds should be removed by hand. Two or three weeks later the grass should be mown again and then top-dressed with the mixture of compost and fertiliser, the latter at the rate of fifteen to twenty lbs. per cubic yard of compost.

Final Levelling.—Where a final levelling has to be done it should be done at this stage, and a sufficiently heavy dressing of the compost and fertiliser should be applied to make it possible to carry out the levelling with a straight edge. When the grass shows through the top dressing, the surface should be lightly harrowed with one of the flexible spirally

woven wire foot-mats in common household use. This is dragged backwards and forwards and smooths the surface, lightly rubbing the compost into the grass, and at the same time acting as a light harrow which aerates the turf and makes the grass stand upright. The use of the wire mat is far preferable to the use of rakes or brooms. A suitable size of mat is four feet by two and a half feet.

Regular Mowing.—From now on the grass should be mown regularly each week or 10 days. This causes the turf to thicken up laterally and prevents the energy of the grass being wasted in useless vertical growth. Regular mowing also causes the leaves of the grass to become finer. Before the green is taken into use the mower should be used without the box so that the clippings are allowed to remain on the surface. They form a very valuable source of humus and plant food.

Rolling now Discontinued.—Henceforth rolling should be discontinued as there is danger of rendering the surface soil too hard and impervious, and on putting greens and lawns where the surface is not dead level, the higher patches are compacted too much and so tend to become bare, whilst the hollows are missed. The result is unevenness in the growth of the grass and the formation of bare patches.

From now on until the green is taken into regular use it should receive a top dressing of compost at the normal rate of a cubic yard (a small scotch cart holds about two-thirds of a cubic yard) per seven hundred square yards of surface every three to four weeks.

Normally the green should be ready for play in four months from planting, though usually it will still be somewhat rough. Traffic and proper treatment will, however, soon produce a true surface.

(To be concluded.)

MAINTAINING THE NITROGEN AND ORGANIC MATTER IN THE SOIL.

Since most of the soil nitrogen is contained in the organic matter, nitrogen and organic matter may to a large extent be considered together. If a soil is to be productive it must contain an ample supply of available nitrogen. This is most easily supplied when the soil contains a plentiful supply of total nitrogen. There are a number of ways in which the supply of nitrogen in the soil may be maintained. The growing of legumes, the use of manures and green manures, and in some cases even the use of commercial fertilisers, will help keep up the supply of total nitrogen in the soil.

Organic matter decays rapidly in a cultivated soil. The more frequently a soil is ploughed and the more intensively it is cultivated, the more rapid the loss of this material. Soils cropped continuously to corn, kaffir corn or other cultivated crops are usually depleted in organic matter more rapidly than soils cropped to small grains; while soils seeded down to alfalfa or grass crops may increase in organic content.

It is important to keep a soil well supplied with organic matter because of its nitrogen content and because of its value, particularly following sod crops, in absorbing water, and in keeping the soil in good tilth. Organic matter is also the principal food of the bacteria which make plant-food materials available. The growing of legumes in the rotation, the application of manure, the return of all crop residues to the soil, and the growing of green manure crops are the methods of maintaining or increasing the nitrogen content of the soil, and particularly the available nitrogen. (Ref. Kansas Agricultural Experimental Station, Bulletin No. 260.)

DO COMMERCIAL FERTILISERS INJURE THE SOIL?

Do commercial fertilisers impoverish the soil? If once used, must they be used continuously? These are questions commonly asked by farmers contemplating using fertilisers.

Instances in eastern states are often cited where it was found impossible to discontinue, without great reduction in soil productivity, the use of commercial fertilisers after they had been used for several seasons. It should be remembered in this connection that commercial fertilisers do not supply organic matter, and in most cases carry only small amounts of nitrogen. It is by means of the organic matter in the soil that most of the plant food is liberated from season to season, and it is in this material that the nitrogen is held. When organic matter is not added, the supply of material that aids in liberating plant-food materials from the soil, as well as the total nitrogen itself, gradually grows smaller. Under such conditions the productivity of the soil might be maintained by increasing quantities of commercial fertiliser that would supply available plant food, including plenty of available nitrogen, but should the fertiliser be discontinued, the productivity of the soil would suddenly decrease. This loss in yield, however, would only represent the decrease due to the gradual exhaustion of the organic matter and certain nutrients of the soil, that would have taken place gradually if commercial fertilisers had not been used. Commercial fertilisers are not crop stimulants—they contain nothing that can in any way injure the soil—but they cannot in themselves be expected to maintain the fertility of the soil. They should, therefore, be used when a good rotation of crops is practised, and *when organic matter is supplied systematically*. (Ref. Kansas Agricultural Experiment Station, Bulletin No. 260.)

LOCUST INVASION, 1933.

SOUTHERN RHODESIA.

Monthly Report No. 3, February, 1933.

1. **Nomadacris septemfasciata.**—No further reports of egg-laying have been received during the period under review, and by the end of the month flying swarms had disappeared. The more advanced hoppers had reached the fourth stage of their development by the end of the month. Further hatchings have occurred in most of the infested districts.

2. **Locusta migratoria migratorioides.**—A few flying swarms have been reported during the month, chiefly from the Sipolilo and Darwin areas. These are believed to consist of adults of the new generation, and all but one are thought to have crossed our border from the north. Neither egg-laying nor new hatchings have been reported. Hoppers have apparently reached the fifth stage of their development, and in one case have changed to adults.

3. **Parasites.**—No further parasites have been reported.

4. **Destruction of Hoppers.**—Operations against hoppers continued in the infested districts, although towards the end of the month in some less heavily infested districts they were confined to occasional expeditions of a minor nature.

The infestation in the southern portion of the Colony developed to a larger extent than was at first expected.

5. **General.**—Control in some areas is proving to be more difficult than was anticipated, owing to successive egg-deposits and a prolonged period of hatching. Driving the hoppers has not proved to be practicable, and reports of definite marching of hoppers, as occurs in other species, have been rare. Experiments in control of Red Locust hoppers in maize lands and in long grass by baiting methods have not yet shown promising results. Ground maize cobs have been found to be as effective as maize meal or wheaten bran as a carrier.

It is expected that there will be six hopper stages of the Red Locust.

RUPERT W. JACK,
Chief Entomologist.

FARMING CALENDAR.

April.

BEE-KEEPING

The notes given for last month will in the main apply to April also, according as to how the season develops. New swarms are not recommended to be hived during this month unless they are supplied in the first instance with fully drawn out frames and the owner is prepared to feed them now and again during the winter. As April should be a very active month for the bees, watch carefully the progress of the crates in which surplus honey is being stored, and have plenty of frames—fully drawn out if possible—ready fixed with foundation so as to place on extra crates as occasion may require; these should be placed under the full or filling one and not on the top, as might appear the case. For the benefit of those who would like a little honeycomb, it might be stated that if two or three shallow frames are fitted with four empty comb sections, and placed in the crate, the bees will take to this plan and so provide both comb and honey for extraction in the one crate. In this African climate full crates can be left on the hive with safety until ready for extraction, but if any are taken off they must be watched now and again until they are extracted for damages from the wax moth, which in a day or so can ruin both the comb and honey.

CITRUS FRUITS.

During the first half of this month, autumn budding can still be performed if the sap is still up and the bark of the stock slips freely. Unprofitable and off type trees that have been headed back for top working and which have been carefully thinned out may have the shoots on which February-March buds have failed re-budded to profitable varieties. If the March rains have been sufficient and ploughing and cultivation have been completed, continue cultivation to retain soil moisture and destroy winter weeds. If a dry March has been experienced and cultivation has been badly performed, irrigation should be commenced or continued to keep the trees and fruit in good order. If not already applied to the unthrifty trees which are late with their autumn flush, soluble fertilisers containing nitrogen and phosphoric oxide can be applied with advantage to these trees. The fertiliser should be worked into the soil with a cultivator and followed up with an irrigation. Exporters should have everything in readiness for packing the early fruit, which should be fit to market about the end of the month. Scale infested fruit will be unfit for export unless treated at once. See entomological notes for treatment.

CROPS.

If sufficiently mature, begin cutting and stooking early maize over a small acreage and plough up the ground whilst still damp between the rows of stooks. If ripe, reap and husk early planted maize, and keep in a separate dump. Continue to make field selections of the best maize plants, and mark those required for seed with strips of coloured cloth. Lift any ground nuts and potatoes showing signs of making second growth. Make silage; cut maize for this when the ears are in the "dough" stage. Pick up and stook maize plants blown over to protect the ears from white ants. Feed sweet potato vines to stock, reserving any new growth of vines for feeding as grazing in May. Plough in any green manure crops not already turned under. Plough fallowed land. Keep potatoes reserved for

seed on racks in a cool place protected from frost, but well ventilated. Transplant onions from seed-beds to irrigated or naturally moist lands; irrigate about once a week, but do not apply too much water. Pick over potatoes which may be lifted, and remove the bad and diseased ones. Winter cereal crops for grain can be sown towards the end of the month. Cart manure to the lands. Remember that good and deep ploughing to a depth of at least 7 to 8 inches is essential, and the basis of all successful arable farming. If the lands are not already ploughed so deep, increase the depth of ploughing about an inch a year until this depth, or even more, is reached. On lands which have been ploughed for a number of years at the same depth, use a grubber to stir up the sub-soil without lifting it to the surface. Too much attention cannot be paid to good tillage. It is usually good practice to follow the plough at once with a harrow or other suitable implement to break down the clods before they bake hard. Continue breaking up new lands; the earlier this is done the more complete is the decomposition of the vegetable matter in the soil. When making hay of coarse legumes such as velvet and dolichos beans and cowpeas, be sure that the vines are dry before stacking. Handle the hay as little as possible to avoid loss of leaf. Thought should be given to laying in supplies of thatching grass for thatching and repairing roofs. The veld may be beginning to dry off. Consideration may be given to mowing or otherwise preparing fire lines as a preventive against veld fires.

DECIDUOUS FRUITS.

If not already done, orchards should be ploughed, harrowed and well cultivated to retain the soil moisture for spring blossoming and growth. Varieties such as the Chinese peaches, etc., may be pruned after the leaves have dropped.

Order all trees for winter planting during June-July. August planting is unsafe for many early growing varieties of fruits.

All late apples should be harvested and stored or marketed.

ENTOMOLOGICAL.

Maize.—Although certain pests, such as earworm and stalk borer, may be in evidence, there are practically no operations against insect pests that can be carried out economically during this month.

Tobacco.—Any remaining plants showing stem borer attack should be removed and burnt. Watch should be kept for the emergence of the adult wireworm beetles. These should be poisoned with a bait consisting of maize bran moistened with a solution of 1 lb. arsenite of soda in 20-30 gallons of water. The bait should be rolled into a small ball and scattered on the lands, one ball to each 10 square yards. The bait should be covered with a few leaves and moistened as required. Chopped green stuff such as Napier fodder may also be used as a carrier for the poison, in which case molasses should be added at the rate of 1½ gallons to 10 gallons of the arsenite solution, or cheapest sugar at the rate of 8 lbs. per 10 gallons. The bait is best laid in the evening.

Cotton.—Damage to bolls from bollworms may be noticed by the flaring of the bracts and the dropping of the bolls. All dropped bolls should be collected and destroyed. Guinea-fowl, turkeys, etc., may be encouraged to destroy stainers, etc. Stainers should be trapped in traps of cotton seed or trash and destroyed.

Citrus.—Collect and destroy infested fruit to keep down citrus codling moth. Red scale should be destroyed by fumigation with hydrocyanic acid gas or with resin wash. Soft brown scale may be controlled with resin wash. It will be controlled by fumigation with hydrocyanic acid gas where this is practised against other scale insects. Aphis may develop on young growth and may be kept down by spraying with nicotine or home-made tobacco wash.

Vegetable Garden.—Plants of the cabbage variety are liable to suffer severely from cabbage louse and Bagrada bug. The former can be kept largely suppressed by frequent washings with a strong spray of cold water or with a nicotine spray. Bagrada bug is more difficult to control. Crude carbolic emulsion, 1 part in 15 parts of water, or resin wash gives partial control. The spray must hit the insect to kill. Do not re-plant a cruciferous crop (cabbage family) on the same plot. Thoroughly clean and work the soil.

Potatoes.—Potatoes should be cultivated systematically and hilled up to keep the tuber moth from the tubers.

FLOWER GARDEN.

The garden can generally be depended upon to make a good show in the autumn and early winter, provided that the plants have been previously kept in a healthy condition by watering, mulching and feeding. Snap dragons and other seedlings, also cuttings, may now be planted out into their permanent positions. Sowing may be made of hardy annuals, such as hollyhocks, larkspur, clarkia, pansy, petunia, sweet peas, gaillardia and candytuft. Bulbs of spring flowering plants may be taken up, divided and replanted.

VEGETABLE GARDEN.

Sow at once all that is required to fill up the vegetable garden before the soil has parted with all moisture. Seeds sown now will germinate freely, and plants will establish themselves more quickly than during the colder weather, which can soon be expected. A start should now be made at cleaning asparagus beds. This is a most popular vegetable, and yet one rarely sees it cultivated in the ordinary Rhodesian garden. It is supposed to be difficult to grow, but this supposition is not borne out, as, once established, a bed of asparagus is one of the most easily managed vegetables in the whole garden. Depth of good soil and plenty of manure are all that this plant requires. Rhubarb roots may be taken up, divided and replanted this month. Plant out from seed beds cabbage and onion plants into their permanent quarters. Sow a full crop of peas, broad beans, turnips, onions, lettuce and radish.

FORESTRY.

Cultivate the soil in the young plantations either by means of machines or hand labour. The cultivation will conserve moisture. Hoed out weed growth should be applied as a mulch round the base of each young tree. Be careful not to pile earth round the stems of the young trees. Covering the stems with earth even for an inch or two interferes with sap circulation and invites attacks by termites.

Prune the young trees to single stems. Any exceptionally strong undesirable branch growth may be checked by breaking off the leading shoot, but ordinary branch growth should not be touched.

POULTRY.

The first chicks should now be out, and these, having been hatched, must be well looked after. No food should be given for the first 36 to 48 hours. Leave them to sleep as much as possible. See that they have plenty of fresh warm air, but are not exposed to draughts. After 48 hours give some small grit and charcoal to purify the intestinal tract and aid digestion. A pamphlet dealing very fully with incubation and rearing of chickens can be obtained gratis on application to the Poultry Experts, Department of Agriculture.

One comes across many cases of wrong treatment of chickens in this country, the chief being uncleanliness, over-crowding, giving food too early and dirty drinking water. Two most important foods are animal protein, especially in the form of thick separated or whole milk and green food, especially onions or eschalots or their green tops. The loss in the rearing of chicks is very great; this should not be so if good breeding stock is

used, the eggs from these are carefully handled and incubated and the chicks reared with care and common sense.

Any turkey chicks hatched at this time of the year should be well looked after. They should be kept warm, dry, free from insects, fed on dry food only, given plenty of thick separated milk, onions or onion tops, dry mash and grain. A pamphlet on turkeys and turkey rearing is obtainable gratis from the Poultry Experts.

Ducks should do well during the month, the weather being as a rule cool, moist and bracing; but the houses in which they sleep must not be damp. Duck breeders should always be on the "qui vive" for a round worm called "Trichosoma contortum," which is often fatal to ducks. It is found in the œsophagus, and causes arrest of growth, emaciation and weakness and sometimes epileptiform attacks. A swelling will be noticed at the lower part of the neck, which rapidly increases in size, and death occurs in one to three days. Onions, or preferably garlic, mixed with the food is a good preventive and cure. Another good remedy is essence of turpentine mixed with twice its quantity of olive oil and one or two tablespoonfuls given for a dose.

STOCK.

Cattle.—Where winter conditions are good, early spring calves may be weaned now, but a common practice is to allow them to run with their dams until the early rains. Where supplementary feed is available, April to June are probably the best months of the year for cows to calve in. These months also suit the dairy farmer. Provide succulent feed for the dairy herd. Dry off cows which will not pay for a grain ration during the winter. Bullocks for winter fattening should be selected now.

Sheep.—The ewes should be kept in good shape for lambing. Put the big udder ewes on the green feed.

DAIRYING.

At this season of the year the milking kraal is generally far from clean owing to the excessive amount of mud or dust which has accumulated during the latter part of the rainy season, and in consequence farmers invariably have trouble in producng first-grade cream. Every endeavour should be made to erect a small milking shed in which four or five cows or more can be milked at a time, and every effort should be made to keep the cows clean. The udders should be wiped before milking with a clean, damp cloth, and the farmer should see that the natives' hands are washed with soap and clean water before and after each milking.

If butter is made, the cream and washing water should be put out overnight, and if the cream is churned early the following morning, very little difficulty should be experienced in obtaining a good grain and a firm body in the butter.

From this time of the year onwards, cheese making operations are usually most successful. The evening's milk should not be kept in the dairy, but should be placed outside, preferably in a bath, and covered over with butter muslin, cheese cloth or mosquito gauze netting. Care should always be exercised, however, in using evening's milk. Morning's milk plus a starter usually gives the best quality, and if a starter is used, care should be taken that it shows no signs of gasiness or off flavours.

The season of abundant green pasture is over, and the natural grazing, unless supplemented by some green food or succulent roughage, is not sufficient to maintain a full flow of milk. The most economical supplement to veld grazing at this time is maize silage, and this should be fed in liberal quantities to all milking cows and growing stock. A few pounds of concentrates in addition would also be of great benefit to the milking cows, which should not be compelled to subsist entirely on veld hay and silage.

TOBACCO.

The grading of the brighter grades should be proceeded with as soon as convenient. All leaf which has cured green should be bulked separately and be regularly examined to avoid serious damage through overheating. Tobacco seed heads, when mature, should be removed from the plants and stored where no damage will occur through activities by rats and mice. Care should be taken to store these seed heads with the pods uppermost, as otherwise much seed may be lost. Clear and plough the land soon after the crop has been harvested. Burn old stalks as a control measure against possible carry over of disease

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May.

BEE-KEEPING.

Last month under normal conditions should have seen the last honey flow of the season almost ready for robbing, for which purpose have the extractor overhauled, spare crates available, bee escape boards ready, honey jars and bottles ready for usage, and also have a few spare quilts on hand. Do not rob the bees of too much honey, remembering that sending them into winter quarters with a sufficiency of food means a strong issuing colony in the spring. Any new swarms that it may be decided to add to the apiary, feed well if necessary, to induce stimulative breeding while there is time, or if new young queens have replaced older ones also feed liberally this month in the proportion of one part of cane sugar to two of water; for the somewhat wild Rhodesian bee there is nothing like the Alexander feeder let in from the back. Keep all the spaces under hive stands clean, also inspect daily to see that white ants are not building up from the soil; if this is neglected much loss may follow. When seen, sprinkle diluted kerol from a watering can under the hive stand.

Granulation in the bottled honey can be prevented by first ripening the extracted honey in large tins covered with butter muslin for three or four days by exposure to the sun's rays. It should then be heated to a temperature of 150-160 degrees—nothing higher. As soon as this is reached withdraw the tins and bottle when cooling. The best way to obtain this heating is to place the tins in another receptacle of cold water and boil it up to the required heat, as heating it direct over a fire is very liable to burn the contents or to impair the delicate flavour of the natural honey.

CITRUS FRUITS.

The harvesting of the early ripening fruit should be commenced about the first week in May. Exporters should cure their Washington Navels for a longer period than usual; this will enable them to detect the thick skinned fruit easily. Where necessary, irrigation should be continued up to within ten days of harvesting. All ploughing and cultivation should be completed without delay.

CROPS.

Continue to cut and stook maize as it matures; make the stooks small to assist drying. Later in the season the stooks may be made larger. See that the stooks are secure and pick up plants lying on the ground. Continue to plough up land between stooks of maize. Give all maize harvested, whether husked or in the husk, a chance to dry out before riding to the dumps. Do not begin shelling if the ears are still damp. Do not use new grain bags for harvesting maize. Make the dumps of unhusked ears as small as possible; the smaller the dump the quicker the grain will dry out.

Grain on the cobs dries extremely slowly, if at all, in dumps of large size. Do not mix unhusked ears from the stooks with dryer ears harvested later from the standing crop. Keep the dryer ears in a separate dump; shell, bag and stack such maize separately. When cutting maize for stooking, insist on the stalks being cut within 2 to 4 inches of ground level. The plough, in Rhodesia, will not bury roots with stalks 8 to 12 inches high. A long stubble of stalks makes clearing of the ground for ploughing very tedious and expensive. If not already harvested, ground nuts should be lifted before the first frosts damage the hay. Finish transplanting onions from seed-beds. If plants are not flourishing after transplanting, give a light dressing of nitrate of soda—50 lbs. per acre. Repeat in a fortnight if needed. Sow most winter cereals on wet vleis or under irrigation early this month. Feed your sweet potato vines to stock; if frosts occur the vines will be killed. Dig and feed tubers from end of month onwards. Towards end of month harvest cattle pumpkins and melons and handle carefully; avoid bruising to prevent rotting. Place pumpkins and melons in a dry situation in the open and in a single layer. Supply plenty of roughage to cattle pens, kraals and stables to increase the manure supply. Collect and cart manure to lands for spreading. Do not attempt to plough in dry grass or quantities of maize refuse. The plough will not turn it under and it will not rot before next planting season. Burn such refuse and make a good job of the ploughing. If the weather seems set fair, commence brick-making. A small kiln of bricks always on hand is most useful. As labour permits, re-thatch buildings and outhouses in need of repair. Overhaul, grease and paint planters, drills and other implements not required again until next season, and store away under cover. Think about your fertiliser requirements for next season and place your orders. From now onwards the second ploughing of new land broken up earlier in the season should be pushed on with as opportunity offers.

DECIDUOUS FRUITS.

The pruning of early ripening peaches should be performed this month. All holes should be completed and kept in readiness for June planting. Ploughing or digging and cultivation should be completed without delay.

ENTOMOLOGICAL.

Cabbage Family.—Plants of this family are liable to suffer greatly from cabbage louse (aphis) and Bagrada bug during May. For the former wash the plants frequently with a strong stream of cold water from a spray pump, or spray with soap and tobacco wash. Transplants may be dipped in the latter. Plants attacked by Bagrada bug may be sprayed with resin wash when the young bugs are exposed in the early morning.

Citrus Trees.—Continue to collect and destroy all fruits infested with citrus codling. Fumigate or spray for scale insects if necessary.

Guava.—Fruit fly and citrus codling breed in these fruits during the autumn and winter. Collect fruit and destroy.

Tobacco.—Watch should be kept for the emergence of the adult wire-worm beetles. These should be poisoned with a bait consisting of maize bran moistened with a solution of 1 lb. arsenite of soda in 20 to 30 gallons of water. The bait should be rolled into small balls and scattered on the lands, one ball to each ten square yards. The bait should be covered with a few leaves and moistened as required. Chopped green stuff such as Napier fodder may also be used as a carrier for the poison, in which case molasses should be added at the rate of 1½ gallons to 10 gallons of the arsenite solution, or cheapest sugar at the rate of 10 lbs. per 10 gallons. The bait is best laid in the evening.

Fields of tobacco found to be heavily infested with gallworm should be thoroughly ploughed and cross-ploughed and laid down to an immune crop next season.

Cotton.—Continue trapping and destroying stainers. All dropped bolls should be collected and destroyed.

Maize.—Clean up storage sites, sidings and sheds against weevil.

Potatoes.—Late potatoes should be kept earthed up to prevent tuber moth from attacking the tubers.

FLOWER GARDEN.

The month of May is a suitable one for the preparation of new flower beds. The ground should be well trenched, and if of poor quality, a light dressing of well rotted manure will be a distinct advantage. Too heavy dressing is not advised, as too rich a soil is likely to produce an abundance of foliage and very few flowers. It is not too late to sow sweet pea seeds, but the best results come from early planting. By this time all bulbs for spring flowering will be planted. Chrysanthemums, delphiniums, dahlias and other herbaceous perennials may now be cut down, and if necessary taken up, divided and replanted

VEGETABLE GARDEN.

It will be necessary during the early part of the month to clear off what remains of summer crops, such as haricot beans, peas, cucumbers, etc. Where winter deep rooting vegetables are to be grown, such as carrots, parsnips and beets, the soil and sub-soil should be deeply worked, so as to allow a ready root run for these vegetables. A dressing of lime will be of great value in every section of the kitchen garden. This will especially help to minimise future attacks of insects and fungus attacks. New asparagus beds may be made this month; old beds should be cut down, cleaned and kept in good order; also a light dressing of stable manure may be given to the beds. Planting may be made of all seedlings, such as cabbage, cauliflower, lettuce, onions, etc., and seeds of carrot, leek, lettuce, onions, peas, radish, turnip, parsnip, broad beans may be sown.

FORESTRY.

Continue pricking out coniferous seedlings into tins or beds. Deciduous trees which are propagated by means of cuttings should be taken in hand. See that the fire lines are in order, and in the case of woods which have formed canopy, remove inflammable material below the edge trees.

POULTRY.

All cockerel chickens should be separated from the pullets, and every month gone over carefully, the poorer ones eliminated and only the very best kept. Those cockerels with the deep long bodies, short legs and round heads should be kept. Those with any inclination to long legs, knock knees, long heads or thin beak, lop-over combs, narrow bodies, or those lacking length and depth should be rigorously discarded. The chickens must not be allowed to become chilled, especially at night; on the other hand, they must not sleep in a hot stuffy atmosphere. On no account must they be overcrowded; this is fatal and is one of the many rocks on which poultry keepers come to grief.

The young stock must have all they can eat; to stint them is to ruin them for good and all. A bird that has been stunted never recovers. A good quality bone meal (lime phosphate) is absolutely necessary, as is also plenty of succulent green food, and no animal protein is better than thick separated milk for the health and growth of the chickens.

Those going in for ducks should hatch according to the numbers they have to supply for eating each week. Ducks must have all the food they will eat from the time they are hatched. A quick-growing duck should put on 1 lb. per week and be ready for killing at from seven to eight weeks old. Always kill or sell for killing just before the large wing feathers commence to grow.

If the rains have stopped, turkeys can be hatched. See that the youngsters are kept warm, but also that they have plenty of fresh air. Never feed young turkeys on wet or moist food, but give dry mash, grain, plenty of onion tops or onions chopped small, and thick separated

milk. Keep them free from insect vermin; they will never thrive if they are infested with these.

Never allow the hen that has hatched the turkey eggs to run with the youngsters. Always confine her in a coop, through the slats of which the young turkeys can run in and out. The coop should be moved to fresh ground each day; nothing is worse for young turkeys than to be running on the same piece of ground for long at a time. Tainted ground is one of the chief causes of mortality among young turkeys.

STOCK.

Cattle.—By the middle of this month dairy cattle will require more serious attention in the matter of feed. Grass should be cut for bedding, and both cows and calves should be well bedded down at night from now onwards, and cowsheds should be put in good repair. Attention should be given to the water supplies, and care taken that they are clean and sufficient.

Boggy sources of water supply are a frequent source of loss of cattle during the winter months. With adequate water supplies cattle can withstand considerable shortage of grazing. Weaners should be fed a good roughage ration—with or without a small allowance of grain, depending on circumstances—to keep them growing through the winter months.

Get in the bullocks for winter fattening.

Sheep.—The ewes should be lambing now. It is the general experience in the Colony that winter lambs are better than spring ones. Adequate feed must be provided to keep up the milk flow of the ewes. For this purpose a stand of winter oats or barley, on which the ewes can graze for an hour a day, is excellent. A little maize with a legume hay will also give very good results. Where roots do well, they will make a valuable succulent feed for sheep. The sheep should have access to some shelter from the cold winds. Dock the lambs.

TOBACCO.

Curing should be completed as early in the month as possible to prevent loss from frost. The bales of tobacco should be examined and turned weekly until they are despatched from the farm. All bulks must be inspected regularly and turned if necessary. Tobacco seed should be shelled as soon as the seed pods are dry and the seed carefully labelled and stored in a dry place. The stumping, clearing and ploughing of new land, if operations have not already been commenced, should be no longer delayed. Land which has just produced a crop should be ploughed and harrowed as soon after the harvest as possible.

VETERINARY.

Horse-sickness will still be in evidence, and may be expected to continue until the frosts occur. Inoculation for blue tongue should be performed in the dry season only, unless the animals can be kept under cover for 21 days. Do not inoculate ewes in lamb on account of abortion. Inoculated animals spread the disease for 21 days. Scab is a poverty winter disease.

WEATHER.

During the major portion of this month the ordinary winter conditions prevail, viz., cloudless sunny days and cold nights. Frost may be normally expected at any time during the latter half of the month. There is often, however, a recrudescence of rain conditions during the early portion of the month, resulting in overcast days and light drizzling showers, the normal rainfall at many places, particularly in the southern and eastern portions of the country, amounting to over half an inch.

SOUTHERN RHODESIA VETERINARY REPORT.

January, 1933.

AFRICAN COAST FEVER.

One case of coast fever occurred on the farm Welgelegen amongst the cattle removed from infected veld through temperature camps during June and July last. It is believed that infection was picked up on the farm Vooruitzicht, where the herd had been taken for dipping.

FOOT AND MOUTH DISEASE.

No fresh developments. Owing to the appearance of this disease in the Tati Concession the Special Native Police Cordons were transferred from the Gwelo and Gwanda districts to the border of the Bechuanaland Protectorate, and a cattle free belt varying in width from three to five miles was established along the border. Several cattle inspectors were transferred for intensive supervision in the districts adjoining the Protectorate and until the end of the month no appearance of disease had been found.

SWEATING SICKNESS OF CALVES.

Prevalent in the Melsetter, Victoria and Midlands districts.

TRYPANOSOMIASIS.

Nine cases in cattle were reported on two farms in the Melsetter district and also some cases in Umtali amongst cattle forwarded from one of these farms for sale.

TICK INFESTATIONS.

Heavy tick infestations are reported from various districts and there has been a marked increase in the mortality from gallsickness and redwater.

IMPORTATIONS.

From the Union of South Africa: Horses, 3.

EXPORTATIONS.

Nil.

J. M. SINCLAIR,
Chief Veterinary Surgeon.

SALES.

AGRICULTURAL EXPERIMENT STATION, SALISBURY.

Spineless Cactus Slabs (blades) Algerian variety, per 100 slabs, 7/6 Salisbury, or 12/6 delivered free by rail to purchaser's nearest station or siding in Southern Rhodesia. For amounts of 500 slabs or more a reduction of 2/6 per 100 will be made.

Stocks are limited and delivery cannot be undertaken after 15th November.

Kudzu Vine Crowns, per 100 crowns, 15/-, Salisbury, or 25 crowns, 7/6; 50 crowns, 15/- and 100 crowns, 22/6, delivered free to purchaser's nearest station or siding in Southern Rhodesia. Delivery during September and October for irrigated land, and in January for dry land. Owing to pressure of other operations, it is not possible to deliver Kudzu crowns during November and December.

Woolley Finger Grass: 10s. per bag of roots, delivered on rail nearest station or siding; supplies limited. Available January and February.

The prices quoted above do not include charges for road motor transport. Cheques should be made payable to the Department of Agriculture, and preliminary enquiries and subsequent orders should be addressed to the Chief, Division of Plant Industry, Department of Agriculture, Salisbury.

SOUTHERN RHODESIA WEATHER BUREAU.

FEBRUARY, 1933.

Pressure.—Barometric pressure was slightly below normal in the north and east and above normal in the west.

A low pressure system lay over Madagascar from the 1st to the 6th, and from the 14th to the 28th.

The equatorial low moved to the south coast on the 7th and was very deep on the 8th and 9th, and a trough traversed Southern Rhodesia on the 10th and 11th.

Further movements occurred on the 11th-13th, 14th-15th, 16th-17th and 20th-23rd. A trough joining the equatorial low to the Madagascar depression lay across the northern part of Southern Rhodesia from the 19th to the 25th.

Highs were comparatively inactive. The first of importance passed round the coast and became central on the 5th. The second followed the equatorial through Southern Rhodesia and was central on the 12th. The third appeared on the west coast on the 18th and was central in the Transvaal on the 21st, and the fourth appeared on the south-east coast on the 26th and affected Southern Rhodesia on the 27th.

Temperature.—Temperatures were generally low in the north, but in the south and west maximum temperatures were considerably above normal.

Rainfall.—The rainfall for the period October to January, calculated from all stations, is 19.63 inches, or 2.77 inches above normal. The rainfall from telegraphic stations for February amounted to 2.42 inches, approximately 3.3 inches below normal, so that the average rainfall at the end of February was slightly below normal.

FEBRUARY, 1933.

Station.	Pressure Millibars, 8.30 a.m. Mean.	Normal.	Temperature in Stevenson Screen ° F. Absolute. Max.	Min.	Mean. Max.	Min.	½ Max. Min.	Normal.	Dry Bulb.	Wet Bulb.	Rel. Hum. %	Dew Point F.	Cloud Amt. 0-10	Precipitation. Ins.	Normal.	No. of Days.	Altitude (Feet).
Bulawayo ...	867.9	867.0	93	48	83.4	58.2	70.8	70.3	69.9	62.0	64	57	3.9	...	4.1	...	4,436
Gwelo	861.3	...	91	49	80·4	58.4	69.4	70.9	65.9	62.2	81	60	5.5	2.30	5.3	6	4,638
Riverbank ...	...	...	96	50	88.0	59.5	73.8	73.5	72.6	63.7	61	59	...	0.11	4.5	2	4,100
Essexvale ...	...	...	98	50	86.9	61.1	74.0	72.9	69.3	63.8	74	61	...	0.16	5.2	2	3,828
Gwanda ...	904.4	...	96	53	84.7	61.5	73.1	...	72.9	65.6	68	62	3.3	...	3.7	...	3,235
Mazunga ...	946.8	947.2	104	53	89.4	63.8	76.6	78.3	76.6	67.4	62	62	3.7	0.16	3.2	1	1,970
Nuanetsi ...	...	...	102	53	88.4	64.0	76.2	...	75.1	68.9	73	66	4.3	0.69	2.2	4	1,630
Enkeldoorn ...	856.3	...	87	50	78.7	58 0	68.3	69.7	66.8	62.1	77	60	5.6	2.06	6.2	5	4,820
Gatooma ...	...	...	94	52	84.8	59.0	71.9	73.8	70.3	64.9	75	62	3.8	3.15	7.7	11	3,850
Miami	877.2	...	86	57	77.6	61.6	69.6	...	68.2	64.3	81	63	7.5	6.49	5.0	17	4,090
Salisbury ...	853.5	853.8	87	51	78.9	57.4	68.1	69.4	68.7	62.1	69	58	5.7	5.36	5.2	12	4,890
Sinoia ...	886.6	...	92	54	83.2	61.0	72.1	...	70.8	65.3	75	63	5.3	5.59	7.3	12	3,804
Sipolilo... ...	...	...	86	56	78.0	60 7	69.4	...	69.4	64.4	76	62	5.0	4.07	8.2	12	3,900
Inyanga ...	...	...	84	50	74.7	56.2	65.5	..	67.3	59.8	65	55	5.1	4.83	8.7	12	5,560
Bindura ...	...	...	86	57	80.2	62.0	71.1	...	69.4	64.6	77	62	5.0	4.20	8.7	12	...
Angus Ranch ...	...	...	95	59	84.8	66.6	75.7	76.4	74.9	69.6	76	67	...	1.96	4.1	6	2,300
Craigendoran ...	...	...	94	56	84.1	62.1	73.1	...	73.5	66.9	71	64	...	2.14	5.6	5	3,410
New Year's Gift	...	...	94	53	83.0	62.4	72.7	...	72.9	67.3	75	65	...	2.21	5.0	7	2,700
Rusapi ...	...	...	89	53	80.5	58.5	69.5	...	69.4	63.1	70	60	4.8	3.91	5.4	5	4,640
Riverdene North	...	...	97	48	84.4	59.0	71.7	...	69.9	64.9	76	62	...	2.13	4.3	8	3,700
Stapleford ...	...	...	80	45	70.7	54.0	62.4	...	62.6	60 1	86	58	6.8	7.41	16.9	17	5,450
Umtali	891.3	891.8	89	55	80.8	61.4	71.1	71 5	70.7	65.2	75	62	6.4	3.68	6.3	14	3,677
Victoria ...	894.1	893.9	93	51	81.8	60.7	71.2	71.5	70.4	64.3	71	61	4.6	1.58	5.0	9	3,580
Melsetter ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	5,060
Mount Selinda	...	...	90	53	77.5	61.2	69.4	...	69.7	65.3	79	63	4.4	2.76	11.7	10	3,520
Manchester ...	...	...	80	49	72.4	56.7	64.5	...	59.3	57.3	89	56	...	5.66	...	15	...

Rainfall, February, 1933, in Hundredths of an Inch. Telegraphic Reports.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Total.
...	...	...	...	...	...	...	...	...	...	4	2	...	...	...	...	...	...	...	4	1	...	4	..	...	..	...	...	...	...	...	15
...	...	33	...	2	...	...	...	...	31	8	9	...	...	2	...	...	...	...	14	4	...	10	...	...	...	...	...	...	...	...	113
...	1	19	8	3	...	...	...	...	2	112	...	...	3	...	...	...	...	1	9	5	2	129	13	...	...	13	...	...	...	...	320
...	...	4	...	...	...	...	...	...	2	59	4	...	...	...	...	...	...	11	13	4	38	51	26	...	...	...	...	...	...	...	212
...	...	...	...	...	...	...	...	...	...	...	...	...	...	31	...	...	...	15	46	12	...	...	12	...	...	...	...	...	...	...	116
...	...	...	1	...	...	...	...	...	8	9	6	12	5	5	...	...	...	13	68	59	49	33	93	29	...	...	12	...	...	...	402
...	...	1	...	1	...	...	...	...	6	56	10	1	6	3	...	...	...	1	45	28	27	63	109	24	...	...	...	...	...	...	381
...	3	4	8	...	...	...	...	...	2	9	22	27	7	30	3	1	...	4	33	36	19	107	83	142	...	...	28	...	...	...	568
3	...	14	33	...	...	...	...	...	34	44	8	14	21	34	28	2	...	9	75	27	26	51	31	71	3	...	...	...	...	...	528
...	...	63	47	...	...	...	...	...	11	3	...	...	...	...	...	...	...	...	137	5	29	4	57	66	6	...	...	...	...	...	428
...	...	11	8	...	...	...	...	...	11	22	5	4	4	12	4	...	...	6	40	15	15	28	31	23	1	...	2	...	...	...	242

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THE RHODESIA

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EDITORIAL.

Contributions and correspondence regarding subjects affecting the farming industry of Southern Rhodesia are invited. All communications regarding these matters and advertisements should be addressed to:—The Editor, Department of Agriculture, Salisbury.

Locust Position, April, 1933.—The present locust position is the worst that has ever been experienced. As far as hoppers are concerned, it is much more serious than that of the Brown Locust invasion in 1924. Not only is a greater area of the country involved, but the density of the swarms is also greater.

In the 1924 locust campaign approximately 2,000,000 gallons of spray were used, and the percentage of hoppers which escaped was relatively small. In the present campaign sufficient poison has been issued to this date to make nearly 5,000,000 gallons of spray, and large numbers of hoppers are still present.

The 1924 outbreak was confined to the more accessible parts of the Colony, but in the present case large tracts of unoccupied and badly watered country in the Zambesi Valley and low veld areas are infested and effective measures are impossible.

The main operations so far have been aimed at the protection of crops either on European farms or in the Native Reserves and the destruction of large swarms of hoppers which would have matured in the Colony.

The expenditure on the present campaign is estimated at about £10,000 and owing to the splendid assistance rendered by the farmers the results obtained from this expenditure compare very favourably with those secured in previous locust campaigns in any part of Africa.

Scalding of Cattle after Dipping.—Reports have been received of cattle being scalded through dipping during heavy rains, and the cause has been attributed to the rain driving the solution of arsenic into the skin. The real cause, however, is driving the cattle too rapidly to the tank and immersing them whilst in a heated condition. It is possible too that the driving of cattle rapidly after immersion and before they have had time to dry would have the same effect. Cattle owners are, therefore, advised to ensure that cattle are not driven rapidly before or after dipping.

Publicity Officer's Visit.—Mr. A. J. Bouchier, Publicity Officer of the High Commissioner's Office in London, arrived at the end of March on a six weeks' visit. During April he visited Salisbury, Bulawayo, Umtali and Gwelo to renew contact with the various trade organisations, publicity organisations and business concerns in the Colony. A number of farms were visited and a considerable amount of useful information gathered which will be of the greatest assistance to him in carrying out his duties in England. No opportunity has been lost in improving the services of the Publicity Department of the High Commissioner's Office. Samples illustrating the industrial activities of the Colony have been collected, a new and larger series of mineral specimens obtained and cinematograph films of general interest have been taken. The information Mr. Bouchier has been able to give concerning trade conditions in England has been

of great value and we are sure that his visit has been a profitable one not only to the office he represents, but to the Colony as a whole.

Export of Chilled Beef.—Three commercial shipments of chilled beef to the United Kingdom have now been made from Rhodesia and a total of some 1,500 head of cattle have been shipped on the mail boats which left Capetown on the 7th, 14th and 21st April.

The bulk of the cattle despatched were drawn from the Nuanetsi Ranch. The bullocks were slaughtered in Bulawayo at the Rhodesia Cold Storage and Supply Company's works. The meat was inspected by officials of this Department and meat below the minimum standard for export, agreed to at the Pretoria Conference in December last, was rejected. The rejections up to the present have amounted to approximately 15 per cent. The main cause of rejection has been age, as the majority of the bullocks had quality and conformation required by the preliminary standards in force.

Age may, however, continue to be a stumbling block in the future, as a considerable proportion of the younger bullocks, four to five years of age, lacked somewhat in finish for export, and the tendency will, therefore, be to market the cattle as old as possible.

The transport to Capetown was carried out successfully, and the rejections at the port have so far been only one quarter, which was damaged in transit.

The financial results of these shipments are awaited with great interest, as the cattle passed represent a good commercial sample of low veld ranch bullocks and the selling price should be a good guide as to the future of the trade for this type of ox.

World's Grain Exhibition and Conference.—Competition in the various classes of the World's Grain Exhibition and Conference to open at Regina, Canada, next July, will be exceedingly keen. Up to March nearly 3,000 entries had been received.

As would be expected, the wheat classes were the most numerous, and over 200 of the entries are in the special ten bushel wheat class. This means that about 10,000 bags of the best wheat in the world will be on exhibition. In the remaining wheat classes there are nearly 600 entries.

The maize section promises to be of exceptional interest, about 300 entries have been received, chiefly from Australia, United States, Southern Rhodesia and Canada. The sections for oats and barley are about equal to maize.

Field peas will be represented by over 300 entries; rice by nearly 200 and beans, flax, lucerne, clover, grasses, sunflower, field and garden vegetable seeds by numerous samples from all parts of the world.

Work of the Empire Agricultural Bureaux.—"The Bureaux offer an outstanding example of national economy secured through co-operation in finance," states the third annual report of the Executive Council of the Imperial Agricultural Bureaux published recently by H.M. Stationery Office (1s. net). From the experience which has been gained in the three years during which the Bureaux have been in existence the Council believes that the services which they are called to perform are in modern conditions indispensable to the effective conduct of research into agricultural and veterinary problems.

There are eight bureaux, financed by the British Government, the Dominions and the Colonies. They are controlled by the Executive Council, which is composed of representatives appointed by the Governments of the Empire.

The bureaux have been established in response to a definite need felt by research workers in agricultural science for the collection, collation and dissemination of information on research being carried out in different parts of the world, as well as to fulfil a desire for contact between the workers themselves in different parts of the Empire. These contacts between bureaux and research workers show a striking general development during the year under review.

The advantages to any research worker of receiving information of the developments taking place in his own subject throughout the world, as well as having a ready made bibliography need scarcely be emphasised. Beyond that, the agricutural scientist has the benefit of a list of those working in his field with whom he is at liberty to communicate. He can also apply for the translation of foreign articles. During the year translations have been supplied by the Bureaux of papers issued in most European languages (including Russian, Scandinavian, Hungarian and Polish) and of a few in Japanese.

A perusal of this report can leave no doubt as to the service rendered by the Imperial Agricultural Bureaux through co-operation between the Dominions, India, the Colonies, and the Home country, to those engaged in research into agricultural and veterinary problems throughout the Empire.

HANDBOOK OF TOBACCO DISEASES.

Attention of readers is drawn to the fact that the Department of Agriculture has found it most inconvenient, with the present shortage of staff, to handle the local sales of this book. Arrangements have therefore been made with the Rhodesian Printing and Publishing Company for distribution by them throughout Southern Rhodesia. The book may be obtained from the Herald Store, Salisbury, price 4s., or, postage paid, 4s. 4d.

FATTENING BULLOCKS FOR EXPORT.

By A. E. Romyn, Senior Animal Husbandry Officer.

The successful fattening of bullocks for export depends as much upon the capability of the feeder as upon a wise choice of steers and the feeding of a properly balanced ration.

Fattening cattle is as much an art as a science, and the successful feeder is either born with this art or acquires it from practical experience. There are, however, certain principles of feeding which must be followed, either knowingly or unknowingly, to get the best results, and an attempt has been made in this article to summarise these.

1. **The Bullock.**—A description of the typical export bullock appeared in the April number of this Journal. It was emphasised that the trade requires a handy weight of carcase of about 600-650 lbs. weight or lighter, and that this type of carcase is best furnished by a comparatively young bullock which has received a certain amount of supplementary feed to top it off.

Store bullocks should be well grown, active, comparatively short on the leg, square in the hindquarter, thrifty in appearance and weigh about 1,000-1,100 lbs. on the hoof in fair flesh. The tendency in the future will probably be to feed younger bullocks, but at present the majority of suitable stores will be three to four years of age. There is an element of risk in buying young stores. It needs a good deal of judgment to tell how they will turn out, and a novice is generally well advised to start with fairly mature cattle.

The bullocks should be polled or dehorned. If horned, it is generally advisable to saw off 3 ins. to 4 ins. of the tips of the horns to quieten them.

Where a farmer breeds his own bullocks and knows their possibilities, the selection of feeders is a much simpler

matter than where the bullocks have to be purchased. In the latter case, "that which is well bought is more than half sold," and they should be bought cheap enough to allow a reasonable profit from their feeding, keeping in view their probable value for export.

The approximate amount of feed required to produce 100 lbs. of gain in live weight is given in subsequent sections of this article, and, as the value of the manure should equal the cost of labour and equipment, anyone knowing the cost of feeds should be able to work out the approximate cost of fattening under his own conditions. Where the stores are purchased, the cost of railing them to the feed lot and back to the market when finished must be added, plus the shrinkage in transit and any marketing expenses.

2. **Systems of Feeding.**—The system of feeding will vary with the type and condition of the bullocks and the season of the year.

Speaking generally, there are three methods which may be followed:—

(a) The bullocks may be fattened on grass while the grazing is good.

They are run in convenient sized camps with good water and shade, and fed twice daily on sufficient concentrates to get the finish required before the grass goes off. If the pasture is poor or scanty, this method of feeding will not be successful, as the cattle will require a disproportionate amount of grain, and, having to wander far to pick up the bulky part of the ration, will use up a good deal of this grain in just getting round the country.

Supplementary feeding should start about February, when the flush of luscious grass is past, and continue till April or May, depending on conditions.

Where the grazing is good, this system of feeding is very economical, but it requires a well bred, beefy type of fairly mature bullock, which will take to feed easily and is acclimatised, to give the best results.

A promising development of this system is to purchase suitable two or three-year-old feeders the winter before they are to be fattened for export. They are carried through the winter on roughage and topped off with a light grain ration on grass the next season when three or four years old. The chief disadvantage of this method is that the feeder's capital is tied up for a long period.

(b) The bullocks may be finished entirely in pens during the winter months.

Kraals or pens of convenient size are made with a certain amount of shelter from the sun and wind. The bullocks are left loose in these pens in properly-sized lots. As competition encourages the appetite, it is usually not advisable to tie up the bullocks if care is taken to remove quarrelsome beasts as they show themselves. This method of fattening suits the maize farmer, who often has little suitable grazing available at the time he wants to feed, and is the most satisfactory method of fattening unacclimatised cattle quickly.

(c) The third method is a combination of the two just described.

The bullocks are brought in or purchased near the end of the grass season, and given a certain amount of supplementary roughage while still "on grass" to keep them from losing weight until the maize crop is ready. They may also be used to clean up the stalks and litter in the lands before they are put into pens for fattening. In either case, however, care must be taken that the bullocks come from similar veld to the type on which they are to be fattened, or they may lose a great deal of condition before they settle down.

This method of feeding gives better results with mature bullocks in medium to thin condition than with young bullocks, especially if the youngsters carry a fair amount of flesh to start with.

3. **General Management.**—When the grazing is good considerable difficulty is sometimes experienced in getting bullocks to eat concentrates. This trouble is most likely to occur where the cattle have not been accustomed to previous feeding. To forestall this difficulty, one of the best methods is to bring the cattle in for a short period at the end of the previous winter and feed them roughage and a little grain and so accustom them to feeding. This will keep them in fair condition until the grass is ready, and they will then feed readily when it is desired to fatten them. Otherwise they should be taught to feed as weaners.

Non-doers or bad feeders should be removed from the feeding lot as soon as they are noticed. They will only prove a source of loss and should be disposed of off the veld as soon as possible. Quarrelsome beasts should be removed in the same way. Good clean water and shade should always be available.

4. **Grass-Fed Bullocks.**—Young cattle make excellent gains on good pasture, or even on indifferent pasture if the grazing is well managed, but they do not, as a rule, put on the finish required for export unless fed some grain as well for a period of 60-90 days. The feeding of grain has, moreover, the supplementary advantages of reducing the shrinkage on the way to market, improving the quality of the meat and the appearance of the carcase after chilling. It should be noted that young cattle seldom chill well unless well finished.

The amount and nature of the grain ration required will depend on the condition of the bullocks and the feeding value of the pasture.

On "average pasture," the quantities given below can be taken as a general guide for the feeding of the type of steer recommended for export.

Amount of concentrates required per day:—

January, nil; February, 2 lbs. (including ½ lb. ground nut cake); March, 6-8 lbs. (including ¾ lb. ground nut cake); April, 9-10 lbs. (including 1 lb. ground nut cake); May, 10 lbs. (including 1 lb. ground nut cake).

Instead of ground nut cake, the feeder can use, either singly or in combination, double the quantity by weight of any of the following farm-grown protein concentrates: Ground nuts ground in shell, ground cow peas or kaffir beans, velvet or dolichos beans ground in pod, cotton seed or cotton seed cake, or about 5 lbs. of a legume hay provided that the cattle will clean up this amount of hay in addition to their normal grazing.

The pasture usually gets short in April or May, and to keep up the rate of gain it is then a good plan to supplement the natural grazing and the concentrates with some succulent green food such as green maize, sweet potato tops or silage from the previous season.

The bulk of the concentrate ration should be maize meal. Sunflower head meal (whole head and seeds) is, however, almost universally used as a supplement to maize for the fattening of bullocks in this Colony, and it can satisfactorily replace approximately one-third of the maize. About 1 lb. of salt and 2 lbs. of sterilised bone meal should be added to every 100 lbs. of the concentrate mixture, or the bullocks should be given free access to bone meal and salt in separate troughs which are sheltered from the rain to prevent waste.

On this scale of feeding, the bullocks should gain from 2-3 lbs. per head per day, and be ready for export in 60-90 days depending on the value of the pasture and the fleshing of the steers to start with. Mature steers take less time to finish than younger bullocks. Under this system of feeding it requires about 250 lbs. of concentrates per 100 lbs. gain in live weight, and the cost of finishing usually amounts to about £1 at the current cost of feeds.*

5. **Stall-Fed Bullocks.**—Fattening bullocks in the winter is more expensive than fattening them on grass in summer, but it has the advantage that the manure is saved. Pigs can also be used to follow the steers and so save a good deal of grain which is otherwise wasted.

It generally takes 90-120 days to fatten a bullock properly. A fair average is 100-110 days. A shorter feeding

* Concentrate mixture, 3s. 6d. to 4s. per 100 lbs. Hay, other than veld hay, 20s. per ton. Maize silage, or its equivalent in succulent feeds, 10s. per ton.

period than 90 days does not as a rule produce the finish required unless the steers are in particularly good flesh to start with. Young steers generally require a longer feeding period, and a ration containing proportionately less roughage than older steers, but, as a compensation, they put on more weight for a given quantity of feed and produce flesh of a better quality than the older steer.

The methods of feeding in this country differ considerably from the procedure ordinarily followed in England or America. In England extensive use is made of roots, which have not proved an economic crop in Southern Rhodesia; and in America much heavier concentrate rations are generally used than have proved profitable in South Africa.

(a) *Roughages.*—The maize silage supplemented by good quality veld hay or a mixture of veld hay and some legume hay is generally the most satisfactory roughage mixture. Sunflower silage and mixed maize and bean silage may take the place of the maize silage. Good veld grass silage may possibly give as good results as maize silage, but we need more experience with this feed. Kaffir melons and pumpkins can take the place of part or all of the silage, but as they are watery feeds they should not be used to excess. These latter crops are very palatable, however, and are often better relished by fattening cattle than the drier silage.

The silage should be chaffed and fed in troughs. The hay should generally be fed long from a rack. When a legume hay (velvet bean, dolichos, cow pea, etc.) is used, it may pay to chaff it and feed it in a trough, as these hays are expensive and there is less waste when they are fed this way. The bullocks should be fed as much roughage as they will clean up. The more frequently the hay and silage in front of them is changed, the more they will eat.

If these roughage feeds are of good quality, no concentrates need be fed for the first 30 days, otherwise the steers should get 1 lb. of ground nut cake per head per day, or, instead of the ground nut cake,

2 lbs. of one of the farm-grown protein concentrates given in a previous paragraph.

During the feeding period a bullock will generally consume an average quantity of about 25-30 lbs. of silage, or double that quantity of succulent feed, and 5-10 lbs. of hay per day, taking more roughage at the start than at the end of the feeding period.

(b) *Concentrates.*—After 30 days a start should be made with the grain ration, commencing with 2 lbs. per head per day, and in two or three weeks the bullocks should be getting an approximate ration of 10-12 lbs. of concentrates per day containing about 1½ lbs. of ground nut cake or its equivalent in farm-grown protein concentrates. As the grain ration is increased, the roughage ration should be decreased in proportion. The actual quantities of grain fed should be determined by the animal's appetite. Feed only as much as will be cleaned up properly and reduce the ration and omit a feed, if necessary, whenever the troughs are not cleared.

If a particularly good finish is desired, the quantity of grain may be increased to 15-16 lbs. per day, but heavy amounts of concentrates are not generally profitable. In general, it has been found more economical to feed a comparatively heavy grain ration for a limited time at the end of the fattening period than a moderate grain ration throughout. Grain for cattle fattening should be ground, unless pigs are used to pick up the waste grain in the droppings.

Where 5-6 lbs. daily of a good legume hay is available, the ground nut cake or othėr protein feed is not necessary, and the grain ration can consist of maize with just sufficient other feeds to render it palatable. In practice, satisfactory results can be obtained with maize as the sole concentrate, but generally it is desirable to have a concentrate mixture made up of more than one feed, so as to make sure of a good protein balance. Sunflower head meal is a common

substitute for part of the maize. Sweet potatoes can take the place of one-third of the maize ration, 3 lbs. of sweet potatoes replacing 1 lb. of maize. Bone meal and salt should be fed at the rate already indicated.

Feed at regular hours and avoid any abrupt changes in the rations or feeding routine. The grain should generally be fed twice daily on the silage, morning and evening. Ample trough room should be allowed. The cultivated hay should be given mid-day, and, if practicable, last thing at night as well. Veld hay can be left before the cattle all the time and the surplus used to bed down the stalls for incorporation with the manure.

From experiments in the Union it has been found that three to four-year-old bullocks of beef type will maintain a gain of 2-2½ lbs. per head per day on the rations described, and should be ready for export in about 100-120 days. The bullocks should be marketed as soon as this stage is reached, as gains after this point are expensive, and very fat bullocks are not wanted.

The quantity of feed required to produce 100 lbs. of gain varies with the proportion of concentrates used and the quality and manure of the roughage feeds. Where the rations have been properly balanced, the following quantities are fairly representative of the amount of feed required to produce 100 lbs. of gain in live weight: Concentrates, 450 lbs.; hay, 500 lbs.; silage, or the equivalent in other succulent feeds, 1,500 lbs., or a total of about 900-1,000 lbs. concentrates; 1,000 lbs. hay; 3,000 lbs. silage; for the fattening period giving a cost of approximately £2 10s. to £3 per head for feed.

6. **Fattening Pigs behind the Cattle.**—In America a certain number of pigs are usually run behind the steers to pick up the feed voided in the droppings. On a limited scale this method has been tried with success in the Union, and has yielded a profit of 10s. to 15s. per pig to be added to the return on the fattening of the steer. The pigs find the major

portion of their keep in the droppings of the cattle, but a small amount of supplementary feed, usually separated milk or meat meal, should be given to them in a separate enclosure to "balance" the maize found in the droppings.

The system should be tried here.

The type of pig required is a vigorous store pig, 80 to 100 lbs. in live weight, which can look after itself and keep out of the way of the cattle. When the pigs get beyond 140 to 150 lbs. they become lazy and should be finished in sties and their place taken by more active pigs. One pig is run to two to three steers depending on the heaviness of the grain ration. If pigs follow the steers, it is more economical to feed shelled maize than maize meal. If hard and dry this maize should, however, be soaked before feeding.

7. **Preparation for Market.**—It is advisable to get the steers on to dry feed for two or three days before shipping. The ration of silage or succulence should be cut out and the hay increased. The steers should be driven to the market or the railway siding as slowly and carefuly as possible. Where possible the journey should be made in the cool of the morning or overnight. Loading should be done quietly and the greatest care should be taken not to bruise the cattle with sticks or whips or to rush them against the side of the loading race or truck.

Designs of feeding pens and equipment will be published in a later issue.

THE TSETSE FLY PROBLEM IN SOUTHERN RHODESIA.

By R. W. Jack, Chief Entomologist.

So many misconceptions concerning the nature of the tsetse fly problem, or, rather, problems in Southern Rhodesia, appear to be current that an attempt to make the position clear, at least to the inhabitants of this Colony, needs no justification.

Some Relevant Facts.—One point which is not generally realised by the public is that the term tsetse fly is generic and not specific. There are twenty different species of tsetse flies known to exist in Africa, and the different species vary considerably in their habits and their requirements in regard to environment. They have all, however, as far as is known, one attribute in common, namely, dependence upon living blood as food.

All are forest insects, but some require denser shade than others. Some require thicket or close forest, whilst others avoid both. Some favour a humid climate and others definitely avoid any extreme in this direction and inhabit the drier zones. Some are active more or less throughout the day, others are crepuscular in their habits. The forest requirements and habits of the different species lead to a variation in the type of animal on which they depend for sustenance. Species which inhabit the lake shores and river banks tend to sustain themselves largely on reptiles. The species which inhabit the open savannah type of forest or tree veld are, however, believed to be mainly dependent upon the larger wild mammals.

When, therefore, a statement is read concerning "tsetse fly" in other parts of Africa, it is necessary first of all to ascertain the species of tsetse fly concerned before applying the statement to the species occurring in Southern Rhodesia.

The most important species of tsetse fly in Southern Rhodesia is *Glossina morsitans*, Westw., which now infests some 20,000 square miles of country in the northern portion of the Colony. On the eastern border of the Melsetter district two other species occur, namely, *G. pallidipes*, Aust., and *G. brevipalpis*, Newst. Incursions of tsetse fly from Portuguese territory into the Melsetter district have constituted a serious problem for a number of years past.

Morsitans is an open forest tsetse fly, avoiding the interior of thickets and close forest. It is capable of enduring a comparatively dry, in fact, almost semi-arid climate, and unless the temperature be very high is apparently intolerant of very humid conditions. *Pallidipes* and *brevipalpis* are both thought to be dependent upon thicket, and both may inhabit dense forest, whilst they both occur in decidedly humid zones, although *pallidipes* is not necessarily confined to such.

Glossina morsitans.—The 20,000 square miles of the Colony at present infested with this species constitutes only a portion of its former range in the Colony.

It is known that the northern part of the Colony was much more extensively infested during the past century than it is at present, and that the southern part was also infested, the two great fly zones being divided the one from the other by the high veld of the main watershed of the Colony, which is judged to be climatically unsuited to the insect. The "fly country" north and south of the main watershed included an area about half that of the whole Colony (see map).

The extent to which the country lying between the tsetse fly limit north of the Limpopo, and that river was actually infested is still somewhat doubtful, although there are published statements which indicate that at one time the fly area in the region was more or less continuous. If that is the case the fly areas had broken up considerably by the late "eighties," so that Selous was able to lead the Pioneer Column at the time of the occupation of Mashonaland through the low veld and on to Fort Victoria without, as far as is known, coming into contact with "fly."

Following the year of the great rinderpest epizootic, namely, 1896, tsetse fly disappeared entirely from the southern part of the Colony, and in the north the great fly area shrunk up to a few comparatively small patches in the districts of Sebungwe, Hartley and Lomagundi. Whether the rinderpest was responsible for the disappearance of fly from such vast areas or not is still a debatable question and need not be dealt with here. The important fact from the point of view of the present problem is that the fly did indubitably disappear from the greater part of the infested country in Southern Rhodesia immediately after that year.

Since that time, concurrently with the increase of game in the more remote parts of the Colony, the fly areas have been gradually expanding towards their former limits.

In 1909, when the present writer first came to the Colony, the fly areas had not been clearly defined, but a number of separate infested areas were known to exist. Within the next few years a reasonably accurate map of the fly areas was drawn up, and year by year the Entomological Branch have kept in touch with the position by personal observations, supplemented by reports from the Native Commissioners and others.

The fly areas have been expanding rapidly, and apparently with increased momentum. The infested area must have about doubled itself between 1908 and 1918, and certainly doubled itself again between 1918 and 1928, expanding from about 9,000 square miles of country to 18,000 square miles. The Colony towards the end of this period, and for several years afterwards, was surrendering about 1,000 square miles of country to tsetse fly each year.

The spread of fly took place mainly in the Zambesi Valley and in the remote and undeveloped Sebungwe district, but was not confined to these parts. The isolated fly areas have gradually been joined up until at the present time they are all confluent, a vast fly area extending from the Gwaai River in the west to the Portuguese border in the Darwin district in the east.

The spread of fly in the Zambesi Valley and remoter parts of the Colony generally, although regrettable, was not of paramount importance. The natives had been accustomed

for many generations to live without cattle or other live stock in these parts and thus had no traditions in this connection. The population generally did not fall back before the advancing fly, but simply acquiesced in the return of conditions to which they or their fathers had been accustomed.

The discovery of sleeping sickness in the Sebungwe district in 1912, however, raised considerable alarm. The position was met by removing the native population from the infected area, and whilst this area has since taken toll of several European lives, the disease has not spread to any definite extent and little has been heard of it for a number of years past. It is to be realised, however, that sleeping sickness might appear at any time in any heavily infested *morsitans* area, and the presence of this insect must, therefore, be regarded as a potential danger to the population.

Fly Affecting European Settlement.—The fly survived the rinderpest year in a small isolated belt embracing part of the Suri-suri River and its tributaries in the Hartley district, and owing to mining and agricultural development in this area, this was regarded as the most practically important fly area in the Colony at the time of the writer's arrival in the Colony in 1909. The area had, however, been thrown open to free shooting in 1905, and the fly was rapidly decreasing. It continued to decrease until 1912, at which time it was difficult to find a single fly in its old haunts. The fly finally disappeared following total, but temporary, deforestation of a considerable portion of its former habitat in connection with a wood contract for the Cam and Motor Mine.

The advance of the fly elsewhere towards civilisation first made itself acutely felt in 1918 on the Gwaai River, where cattle belonging to a European farmer contracted trypanosomiasis (fly disease) and during the next few years native-owned cattle died freely from the disease along a section of this river, finally extending for 60 miles.

Early in 1919 the Government decided to test the possibility of driving back the fly in this region by intensive hunting of game. The operations were commenced in 1919 and continued until 1922.

The results of these operations were (1) the advance of the fly was immediately checked, (2) the surviving cattle along the Gwaai River became free from fly disease by 1922, and (3) fly in the area of operations was greatly diminished, and to all appearance entirely eliminated between the Gwaai and Shangani Rivers.

This result had scarcely been attained in one district when in 1923 attention had to be given to another district, namely, Lomagundi, where the fly was advancing in a south-easterly direction from Doma Hill towards the Hunyani River and had infected a considerable number of cattle owned by both Europeans and natives. The fly continued to advance and in the succeeding years considerably more farms and native herds became involved from near Sipolilo to the Angwa River.

This advance was also fought on the base of game reduction aided by extensive game fences, the operations commencing at the end of 1925. The results at the present day are decidedly satisfactory, and the menacing shadow of the fly's advance has now been lifted from this region.

In the meantime a boom of settlement of the Colony had commenced, and in the Hartley district, north-west of Gatooma, farms were surveyed and occupied in 1925, considerably beyond the limits of previous settlement. Unfortunately the fly, which for a number of years had been confined to the vicinity of the Umniati River, had, unknown to the Entomological Branch, which was preoccupied with the menacing situation in the Lomagundi district, recently spread eastward with remarkable rapidity right up to the edge of the country which was now occupied by new settlers. It was quickly found that cattle could not be kept on the majority of these farms without heavy losses from trypanosomiasis.

The whole district became seriously alarmed at the possibility, which seemed a practical certainty, of further advance of the fly, which could only result in retrogression of settlement and depopulation of the district.

The position in this district was considerably more difficult than in the Lomagundi (Umboe) area. In the latter area, whilst fly could be found near the farms, the edge of the

definitely infested country, where fly was present in considerable density, was about 10 miles from the nearest occupied farms. In the Hartley district comparatively dense fly now occurred close up to the occupied country. The country also is very heavily wooded, and the permanent water holes are few and far apart. In addition to other game, the fly infested area was over-run with large numbers of warthog, the presence of which was probably largely responsible for the rapid spread of fly.

Game fences and game reduction measures were again put into operation, dating from the year 1927. The improvement in the position was a great deal slower than either in Lomagundi or on the Gwaai River, due, undoubtedly, to the difficult terrain and the density of the fly close up to the farming area. Further advance of the fly was, however, quickly stopped, and at the present time the fly has receded considerably and the position on the farms has shown a marked improvement. In order to accelerate results and to drive the fly still further back from the farms, the original ten-mile zone of operations has been increased to 20 miles with 50 additional hunters. No new fencing has, however, been erected in connection with this extension of operations.

Further trouble developed meanwhile in other parts of the Colony. In 1929 and 1930 reconnaissance in the south-west portion of the Lomagundi district revealed the fact that fly was spreading from the Umfuli River northward towards occupied farms in the Gambuli Valley and elsewhere in the basin of the Sisiya River. The Government decided to take action before cattle on these farms became actually infected. The action taken was, however, just too late to prevent this occurring, as in 1930 losses from trypanosomiasis occurred on several of these farms.

A game fence 40 miles long was erected along the edge of the occupied country during that year and operations against game initiated. The position in regard to trypanosomiasis on the farms quickly showed an improvement. The fly has shown no tendency to further spread and appears to be diminishing. The present position is satisfactory.

In the Gwaai River region the operations against game were discontinued after 1922, and an ineffective system of

shooting concessions substituted. Reports were received of gradual increase of both game and tsetse fly, and early in 1927 it became apparent that recrudescence of fly disease amongst cattle on the Gwaai River was probable. A few months later this fear was amply justified.

Operations against game were not immediately undertaken, precedence being given to an experiment in clearing evergreen forest along the Gwaai River in the hope that this would deter the fly from becoming established in this region. After some 10 miles of one bank of the river had been cleared, this experiment was discontinued late in 1928 and a scheme for settling the Gwaai River farms with a hunting class of settler was substituted. This scheme included free grant of title to the land after a period of occupation. The settlement proceeded very slowly for some considerable time, but by 1931 a considerable number of settlers had taken up land. It soon became obvious, however, that the settlement was not likely to effect its object, due to the tendency of the hunters to follow the more valuable game far afield and to fail to hunt sufficiently intensively in the defined zone.

The increase of fly between the Gwaai and Shangani Rivers was phenomenal after 1928, and its density soon exceeded anything formerly recorded in the Colony. The fly also quickly extended in considerable density far beyond its limits in 1919.

Controlled operations against game with paid hunters were commenced in this district in 1931. It is too early for conspicuous results at present, but recent reports and observations indicate appreciable reduction of fly in the previously very densely infested localities between the Gwaai and Shangani Rivers.

Fly Affecting Native Reserves.—Apart from the advances of fly which threatened European settlement, various native reserves, in which considerable numbers of cattle and other live stock were present, have also been involved.

It was recognised in 1922 that the *Shangani Native Reserve* was in danger of being over-run by tsetse fly, and a number of the natives were armed with Martini Henry rifles and supplied with ammunition with a view to keeping down

the game. These operations are still in progress under the direction of the Assistant Native Commissioner, Shangani Reserve, and the reserve has not yet been over-run.

From 1923 onwards the *Sipolilo Reserve* was very seriously threatened, and a considerable number of native-owned cattle died. Native hunters were armed in 1924 under the control of the Assistant Native Commissioner, Sipolilo. The position remained bad up to 1926, but improved rapidly after that year, and since 1928 no cattle are known to have contracted trypanosomiasis in this reserve.

Fly commenced to invade the *Magondi Reserve* about the year 1927, and in 1929 all cattle were removed from the reserve. Native hunters were also armed in this locality in 1929, and are at present under control of the European ranger in charge of the game fence and operations protecting the farming area. The fly position in the reserve has certainly not grown any worse since the operations started, but the absence of cattle is a handicap in reference to a clear definition of the position.

The *Urungwe Reserve* came into the picture in 1929 with advance of fly from the direction of the Sanyati River, and serious losses of native-owned cattle occurred. The position here is particularly difficult, owing to the fact that the fly-infested country in the Sanyati Valley is very broken, practically waterless during a portion of the year and uninhabited. Whilst the fly can be kept from actually invading the inhabited part of the reserve, prevention of incursions of fly from the Sanyati Valley is another matter, and it does not seem possible to carry out effective operations in the dry, broken country in order to drive the fly back.

The *Kandeya Reserve* and adjacent country in the Darwin district has been subject to incursions of fly from the Zambesi Valley for the past 10 years or more, but the fly seems to have failed consistently to establish itself on the higher veld. Intensive hunting operations and other measures, including control of pedestrian traffic from the Zambesi Valley and removal of flies from such pedestrians, seem, however, to have improved the position appreciably.

Completion of the Cordon.—The general and continued tendency of the fly to spread on the higher veld and to

threaten to cause evacuation of European farms and death of native-owned live stock in all infested districts led to a consideration of the whole position in 1929. By this time the results of several undertakings with a view to checking and driving back the fly had produced considerable confidence in the efficacy of operations against game in a defined zone on the edge of the fly infested area. It was also judged that considerably less intensive operations would be necessary simply to hold up the advance of the fly than to cause the insect to evacuate any considerable extent of country. In many sectors it would suffice for present purposes if the fly could be prevented from spreading further afield.

It was eventually decided to attempt to complete a cordon round the edge of the fly area in which game was to be reduced to and maintained at a minimum. This plan was put into effect all along the edge of the fly area a distance approaching 600 miles, with the exception of a comparatively short sector between the Gwaai and Zambesi Rivers in the west where the country is unsuited to effective operations. The cordon, of course, includes the section where determined efforts are being made to drive the fly back from European farming areas, but in general the object is simply to hold the ground.

The control of the native hunters is shared between Native Department officials and rangers specially employed by the Department of Agriculture, of whom eight have been authorised up to the present.

The policy of "open shooting areas" has been abandoned as far as the fly areas are concerned, but the game laws are suspended in certain areas in European occupation behind the cordon (Government Notice No. 1 of 1933).

The present position may be described briefly to the effect that the tsetse fly country constitutes more or less of a large game preserve, round which a zone has been created in which the natural increase of game in the fly country is prevented from spreading outwards. Those who have any knowledge of the rate at which game increases when practically unmolested will realise that around such a vast area thousands of head of game will need to be destroyed annually to keep the increase of game in check, and that this destruc-

tion will not affect the numbers of game within the infested country, provided, of course, that conditions within the infested country are not such as to cause large migrations of game into the game elimination zone. It may be stated generally that such conditions do not obtain in the fly areas.

The fly cordon appears at present to be achieving its object, no definite further advance of the pest on any considerable scale having been recorded during the past two years. Much, of course, remains to be accomplished in the way of rendering certain localities safe for cattle, and improvements in the organisation of the cordon are gradually being effected. The general position to date is, however, distinctly encouraging, and there are definite grounds for hope that this terrible menace is at last generally under control in the northern part of the Colony, with the exception of the short sector in the extreme west, where it has not so far been found feasible to operate.

The Danger Averted.—Whilst the danger to the Colony from the consistent tendency of the fly to spread towards its former natural limits should be clear from the account given of the numerous points at which it has been found necessary to operate in emergency, a clearer definition may not be out of place.

Civilisation has long been judged to be inimical to *morsitans*. There is little doubt that the main inimical factor introduced by civilisation in the form of agricultural settlement in Southern Rhodesia is the driving out of the game or at least the breaking up of its close association with the fly. The suggestion that the comparatively small clearings made in the savannah forest for the purpose of cultivation can have any general effect on the fly will not bear examination.

Areas in reasonably continuous occupation by farmers are probably not in danger of actual invasion by fly, *as long as such occupation continues*. Unfortunately, tsetse flies have a habit of making incursions into country which may be unsuitable at the time for permanent occupation by the insect. These flies tend to infect cattle with trypanosomiasis, and, if the losses continue, the farmers are forced to abandon their farms, which revert to primitive conditions.

A continuation of this process would naturally result in large areas at present in occupation being gradually evacuated and becoming the haunt of both game and fly. The greater part of the Hartley district has been threatened with this disaster, and also much occupied country in the Lomagundi district, including the Umboe Flats, part of the Sipolilo sub-district and the whole of the Lomagundi West farming area. The whole of the occupied country in the Wankie district is ultimately threatened, and also certain occupied areas in the Gwelo, Mazoe and Darwin districts (see map).

As far as native reserves in the potential fly area are concerned, game conditions in the majority of these are or were such that the fly could spread through them without a check, and the same statement applies to other land purely in native occupation.

The Present Position.—The present position may be compared to a large extent with the position on the Western front during the period of trench warfare in the Great War. The advance of the invader had been checked, and a condition of approximate equilibrium established. Neither side could claim a decisive victory during this period, and it may be argued that the Department cannot claim a real victory over the tsetse fly, except in the comparatively limited areas from which the fly has been driven.

It is, however, justifiable to claim that the Department has at least not been defeated.

Moreover, there is one marked difference between the situation in the Great War and the tsetse fly position in this Colony, namely, that in the Great War the invader continued to occupy country which was a severe loss to the defenders. This is not the case with the tsetse fly in the Colony. The infested country is mostly unfit for European settlement or development, although there are a few tracts within accessible distance of the fly limit which can be utilised for farming purposes if rendered safe for live stock. Gradual adjustment of the line to include localities of this nature are to be anticipated.

A few at present inaccessible localities exist in the fly area which would probably be suitable for ranching pur-

poses, but on the whole the actually infested country is of very poor quality.

The natives inhabiting the fly area are the chief sufferers, as they are deprived of cattle, etc., and are forced to continue hand cultivation of their lands indefinitely, but, as already pointed out, they have been accustomed to live under such conditions for generations, and, on the whole, appear to find life sufficiently bearable.

The Question of Finality.—The main objection to the present measures, apart from their general distastefulness, is the lack of finality in reference to results. Obviously operations will need to be continued indefinitely to maintain the position or to reclaim new ground. It may be pointed out, however, that finality in the control of indigenous insect pests is very rarely anticipated. By "finality" is intended control which does not involve recurrent expenditure.

In general, all that is hoped for is that it may be possible to keep a pest from doing too much damage by measures which do not involve too great a recurrent expenditure.

As an instance, the aim in the Union of South Africa is to keep the brown locust in its permanent breeding grounds from increasing sufficiently to swarm and migrate. If this can be achieved—and there are indications that it has in a large measure been achieved—the brown locust will be regarded as under effective control, and the danger of mass migrations of this species, with its attendant menace to crops and grazing, will have been removed from Southern Africa. Maintenance of control is, however, likely to involve an appreciable annual expenditure, possibly exceeding the cost of keeping tsetse fly under control in this Colony.

Control of insect pests is a regular recurring item in the growing of fruit crops, and, where large plantations are involved, the annual expenditure on fumigation and spraying incurred by a single owner may be as high as the cost to the Government of this Colony of tsetse fly control. Justification for such expenditure depends upon the interests involved and the capacity for damage of the pest or pests concerned. The cost of controlling tsetse fly in this Colony by present measures is likely to be materially reduced once the desired

line of defence is established; and the interests involved are, of course, enormous.

Alternative Measures.—The present distasteful measures would certainly not be adhered to in the event of any feasible and equally effective alternative being discovered.

As is more or less generally known, research aiming at discovering methods of controlling tsetse flies is proceeding in various parts of Africa, the largest organisation in this connection being in Tanganyika Territory. Considerable work has also been done in other parts, amongst which may be mentioned Nigeria and Zululand.

With reference to results obtained, it is necessary to confine consideration to the species with which we have to deal, namely, *morsitans*, and on this basis Zululand does not enter the picture, except in so far as measures against the tsetse flies occurring there are also applicable to *morsitans*.

Much of the work in Tanganyika applies to *G. swynnertoni*, although a great deal of attention has also been devoted to *morsitans*.

A certain degree of local success for various anti-tsetse measures is reported in Tanganyika, Nigeria, Nyasaland, Uganda and elsewhere, but these successes are, in the first place, mainly dependent upon factors, which are not generally present in the *morsitans* areas of Southern Rhodesia, and, in the second place, are not of a nature which would meet the main problem in this Colony.

Generally speaking, the measures adopted are too intensive for our purposes and the objective is different.

The objective both in Tanganyika and Nigeria, where success has been obtained, has apparently been to render a particularly useful piece of fly-infested country suitable for habitation by natives with their cattle and other live stock. A general hold-up of the advancing fly over the whole front in all classes of country has apparently not yet been attempted outside of Southern Rhodesia.

It is to be realised, of course, that gradual development of long lines of defence may be the outcome of present research in these countries, but the requisite knowledge to meet

all conditions is not yet available. If such success is finally achieved, it also seems likely to be dependent upon a density of native population many times as great as that of the fly infested districts in this Colony, and also possibly on climatic and soil factors, which are generally wanting here.

Various measures employed to some extent elsewhere may now be considered briefly:—

(1) *Late Controlled Grass Fires.*—Success is reported from this measure in Tanganyika, and it appears also to have given promising results in Uganda, whilst in Nigeria the reports are not so favourable. The measure is dependent upon the occurrence of extensive areas of heavy grass and involves very thorough organisation to protect the grass from premature burning. Unfortunately the tsetse fly areas in Southern Rhodesia consist mainly of either *mopane* forest, in which the grass is usually very thin and scanty and sometimes completely lacking, or poorly grassed *mfuti* (Brachystegia woodiana) forest, and it is obvious that general application of this measure is out of the question. Tests with late grass burning in typical *mfuti* forest in this Colony a few years ago gave very discouraging results.

(2) *Block Clearance of Forest.*—Removal of the forest renders the cleared area unsuited to tsetse, but unless this can be accomplished with unpaid labour, the cost is admittedly prohibitive. Utilisation of unpaid labour depends upon a number of factors which are largely lacking in Southern Rhodesia. These factors include first a considerable native population suffering from shortage of safe grazing for their cattle, and, secondly, good tribal discipline. It is, in any case, a measure which only benefits the natives immediately concerned and is not generally applicable.

(3) *Discriminative Forest Clearing.*—Experiments in reference to removing essential elements of the forest, as opposed to total clearing, have been carried out in various parts of Africa, particularly in Nigeria. The feasibility of this measure depends very much on the nature of the forest, which is determined by climate and soil. A commencement was made with an experiment on the Gwaai River in 1928, but was not completed. There are possibilities in this measure in certain areas, but it is obviously not susceptible

of general application over the whole "front." It is a measure calling for careful experimental investigation in each country concerned. Where this measure involves the total elimination of evergreen trees of fine growth from any locality, it is, however, almost as distasteful as destruction of game; in fact, many people would consider it even more objectionable.

(4) *Barrier Clearings.*—These consist of lines of clearing through the forest, and, to be effective, need to be sufficiently wide to prevent the flies from crossing. It appears that, effectively to prevent such a tsetse fly as *morsitans* from crossing such clearings, they would need to be very wide indeed, and are not regarded as very satisfactory by investigators at present. Their creation on a permanent basis in most parts of the fly area in the Colony would be very expensive owing to the continuous nature of the forest. Barrier clearings have in fact been very carefully considered in reference to certain *morsitans* localities in Southern Rhodesia, but it is judged that the cost would be prohibitive even if the clearing were made only one mile wide; and the effectiveness of this width is highly doubtful. Natives are not available to settle closely in such clearings and the country in most places is altogether unsuitable for such settlement. Such clearings are, however, being experimented with along the Melsetter border in connection with the incursions of tsetse flies from Portuguese territory. This experiment is described later.

(5) *Thicket Barriers.*—The relative dislike of *morsitans* and some other species of tsetse flies for the interior of extensive thickets apparently renders such thicket, if sufficiently long and wide, effective barriers to the passage of the fly. This fact was noted comparatively recently by the Tsetse Fly Research Department in Tanganyika, in referencee to an extensive natural belt of thicket. The feasibility of creating thicket barriers is engaging the attention of the Department mentioned. At present it is not known definitely how wide a thicket needs to be to constitute a complete barrier to *morsitans*. Also the possibility of creating permanent thickets would appear to depend greatly on soil and climate. The feasibility of creating extensive thickets through the naturally open clean-stemmed forest which occurs in most

parts of Southern Rhodesia would appear to be doubtful to say the least, but the experiments in Tanganyika are being watched with interest.

(6) *Settlement.*—A measure which has been utilised to a considerable extent elsewhere and is constantly suggested as an anti-tsetse measure is close settlement.

In the case of native settlement the measure is largely employed with the object of consolidating clearings in the forest. There are certain obvious necessities, including the requisite natives, and also suitable ground and water.

Whilst this measure may prove applicable in certain localities in Southern Rhodesia the paucity of natives in the fly areas and the general unsuitability of the country prevents its general adoption.

With regard to European settlement, under conditions in Southern Rhodesia sufficiently close settlement to create extensive clearings is an impossibility and the chief problem with which this Department is confronted is the protection of settlement from the advancing fly. With the experience of the past any settlement of Europeans, where there is danger of advancing tsetse fly, is likely to be regarded as a reliable method of increasing the Government's liabilities. Such settlement is not, however, discourgaged behind the fenced zones once the fly position has been sufficiently improved. The main point with European settlement in this Colony is that there needs to be a barrier more or less impenetrable to fly between the settlement and the infested country. At present a sufficiently wide more or less gameless buffer zone appears to be the only feasible barrier, which can be created over the greater part of the country concerned.

(7) *Tsetse Fly Traps.*—Trapping is a measure which if effective might be utilised to good advantage to clear limited areas of fly and trapping has received considerable attention from the Entomological Branch of this Department. A great deal of experimentation with traps is also taking place in Tanganyika.

The Harris trap, which is very effective against *pallidipes* in Zululand, has been widely advertised, but experiments against *morsitans* in various parts of Africa, including Southern Rhodesia, have led to the deduction that the same

principle cannot be utilised effectively against this species. From experiments in Tanganyika *morsitans* appears to be one of the most difficult tsetse flies to trap but a certain amount of progress is reported in devising traps against this species. Eradication of fly by means of traps has, however, not yet been achieved anywhere and is apparently only likely to be achieved in isolated fly areas. This question will, of course, continue to receive the attention of the entomologists, but it is obvious that reliance on trapping and any large expenditure in manufacturing traps are not justified at present.

(8) *Biological Control.*—The control of insect pests by means of their natural enemies or parasites is a measure which appeals to entomologist and layman alike. It is not possible to enter into details of the position in reference to tsetse flies and biological control in this article. Briefly, it may be stated that (1) actual extermination of any insect pest is not to be anticipated from biological control and (2) effective utilisation of this measure against indigenous insect pests has so far been only very occasionally possible and then only in limited areas under conditions of intensive cultivation. The prospect of controlling tsetse fly by this means over the country involved in Southern Rhodesia is very poor indeed, but certain research concerning the utilisation of parasites of tsetse is proceeding in Tanganyika and something of value for local application may result.

(9) *Poison Gas.*—This is the measure which seems to appeal greatly to the layman. It is not generally realised that concentrations of gas of sufficient density to kill insects are not readily to be produced in the open air. Insects are much more resistant to most poisonous gases than mammals, including human beings. Moreover, poisonous gases are very much in the nature of double-edged weapons if released in the open and experiments in this connection which embodied any hope of success would almost inevitably involve serious danger to human life.

It is rather curious that use of poisonous gas has been put forward as an alternative to game destruction in controlling tsetse fly. Actually it is highly probable that release of such gas would prove a very effective method of destroying not only game, but mammalian life generally.

In any case use of a poison gas on a really large scale would be excessively expensive and would not be applicable to the general position in this Colony.

No experiments with release of poison gas against tsetse flies appear to have been carried out anywhere.

General.—It will be noted that none of the measures dealt with above are of general application and that all those which have already been proved to be of value are limited in their applicability to country of considerable fertility, producing a heavy growth of grass or capable of supporting a considerable native population.

As already stated the fly area in Southern Rhodesia comprises country mostly of very poor quality with a scanty native population concentrated chiefly in places where small patches of more or less alluvial soil occur on the river banks, whilst considerable areas are practically uninhabited and are, in fact, unfitted for habitation.

Attempts to reclaim limited areas for native occupation have not as yet entered into the problem for the reason, already stated, that most of the natives who are indigenous to the fly areas show no desire to leave the infested country and in fact tend to drift back into it, if officially removed.

The primary objects have been (1) to save the immediately threatened areas, whether occupied by Europeans or cattle-owning natives, (2) to stem the advance of the fly generally and (3) to drive the fly back a sufficient distance where its advance has involved country in which its continued presence or frequent incursions are of particular importance. All three objects appear in a fair way to being accomplished. It would not have benefited the Colony as a whole had efforts been concentrated on reclaiming limited areas, which are not at present needed, for European or native settlement with cattle, whilst the fly generally continued to advance over much larger areas elsewhere, where European settlement was already established or natives already possessed cattle. Nor would it have been wise at this stage to have attempted to create barriers to the fly's advance by expensive measures of doubtful practicability and efficacy which must have been confined to a very small portion of the line involved.

Assuming that effective control of the position is now in sight it is possible to look ahead and to plan at leisure any further measures against tsetse fly which the needs of the Colony may demand. New discoveries may make it possible eventually to do away with the game control cordon altogether although this desirable event cannot be regarded as at all probable on the basis of present knowledge.

It is conceivable, however, that in certain sectors a permanent line of defence might be gradually developed over a sufficient distance by methods not involving too heavy an annual expenditure. Such developments would perhaps admit of the game cordon being correspondingly shortened.

Traffic Control.—The danger of flies being carried by traffic into contact with cattle in fly-free areas has increased with the increased use of motor vehicles for the purposes of prospecting and hunting. In 1929 powers were obtained from Parliament under the Tsetse Fly Act to confine traffic leaving any proclaimed fly area to defined routes and to subject vehicles, cyclists and pedestrians to measures necessary to rid them of tsetse flies. Regulations under this Act have been put in force wherever any serious danger from transported flies has been judged to exist.

The method employed in the case of motor vehicles involves the erection of a specially designed chamber in which the car is treated with a fly spray and any tsetse flies are attracted into a guaze ante-chamber and caught. It is understood that a similar design has since been adopted in some other African States. Smaller gauze cages have been erected on certain routes to deal with cyclists and pedestrians only.

The number of tsetse flies caught at certain of these stations is considerable and undoubtedly they have an appreciable protective effect.

Glossina pallidipes and G. brevipalpis.—In Portuguese territory adjacent to the eastern border of the Colony in the Melsetter district two species of tsetse fly occur and for nearly twenty years the farms near the border have been subject to incursions of tsetse flies which have caused very considerable losses of cattle. It is believed that these incursions are mostly on the part of *pallidipes* which is generally credited with wider ranging propensities than *brevipalpis*, but this is uncertain.

An experiment was started last year in creating a cleared barrier along the border for a sufficient distance to give results, if effective, in protecting the farms from incursions of fly. Clearing is a feasible proposition in the locality concerned because most of the ground is naturally open grassland and the patches of forest are limited. If the results from the preliminary clearing are satisfactory, extension with the object of protecting all the farms which have suffered in the past will need to be considered, although not all of the fly-infested portion of the border is as easily cleared as the sector dealt with last year, and in some parts the forest is approximately continuous for considerable distances.

In concluding this article the writer is moved to remark that abhorrence of large scale destruction of wild life must not be allowed to obscure the hard facts of the position. The threat to this Colony from the tendency of the tsetse fly to spread outwards towards its former haunts is no fantasy. The Colony a few years ago was threatened with nothing less than disaster, developing slowly, it is true, but none the less real. If it had not been found possible to hold the fly in check very considerable and valuable areas must inevitably have already been evacuated by European farmers and the Government would have been confronted with the fact that the portion of the Colony available for farming and ranching purposes was becoming appreciably smaller year by year. Spreading tsetse fly can only be compared with a malignant disease and the most ruthless measures must be used in fighting it.

Game preservation in Southern Rhodesia may be said to have been provided for on a generous basis. The main game reserve in the Wankie district is between 5,000 and 6,000 square miles in extent and there are other smaller reserves. The game laws are in force wherever there is no immediate need to consider tsetse fly. There is no present threat to the game in the fly infested Zambesi valley and Sebungwe district, in fact, as previously stated, 20,000 square miles of actually fly infested country may be regarded for the present more or less as a great game preserve.

A. microcantha.

NOTES ON AFRICAN ALOES.

By H. Basil Christian, Ewanrigg, Arcturus.

PART VIII.

Aloe Microcantha.—*Aloe microcantha* belongs to Berger's Leptoaloe group and is of the *A. Cooperi* type. It is described and illustrated in "Flowering Plants of South Africa," pl. III. It occurs in the open grass veld along the Eastern mountain range from Grahamstown North to the Limpopo. In the Eastern Transvaal and Swaziland it is usually found along the edges of streams and in swampy places. Under cultivation in Southern Rhodesia it flowers in December, January, February and again in July and August if watered.

It increases rapidly by means of suckers from its base. In the wild state after the seeds have set, the leaves wither almost to their base. Owing to the dull pale colour of its flowers it is not a showy aloe.

Description: An acaulescent plant.

Leaves up to 33 c.m. long, 4 to 5 c.m. broad at the base, lanceolate, acuminate, acute, concave, sparsely covered with greenish-white spots near the base, and with rigidly ciliate margins.

Inflorescence about 50 c.m. long, terete, glabrous, bearing a few distinct membranous, ovate-acuminate, acute bracts. Inflorescence congested, corymbose.

Bracts 1.5 c.m. long, ovate, acuminate, acute.

Pedicels 2.8 to 3.2 c.m. long, filiform.

Anthers linear.

Ovary 1 c.m. long, cylindric; style 2.7 c.m. long, filiform, stigma simple.

Aloe Sessiliflora.—*Aloe sessiliflora* was first collected by Wickens in the Barberton district in 1914. There are two varieties of this aloe, this one, which is arborescent, from Barberton, being described below, the other, which is acaulescent, occurs at Wylie's Poort, Northern Transvaal. It is fairly quick-growing and thrives under Southern Rhodesian conditions, flowering in August. The inflorescence is not very attractive. During the winter months the foliage is of a distinct reddish colour, while in summer it is a bright green.

The characters of the inflorescence and general structure of the flowers show that the plant is related to *A. castanea*, Schon. It differs from *A. castanea* in having a less robust habit of growth, while its leaves are spreading and not quite so fleshy.

The flowers and seed capsule are also much smaller than those of *A. castanea.*

Description: Pole Evans. Trans R. Soc. S.A. Vol. V., page 708.

Herb succulent becoming fructicose, stems up to 90 c.m. high.

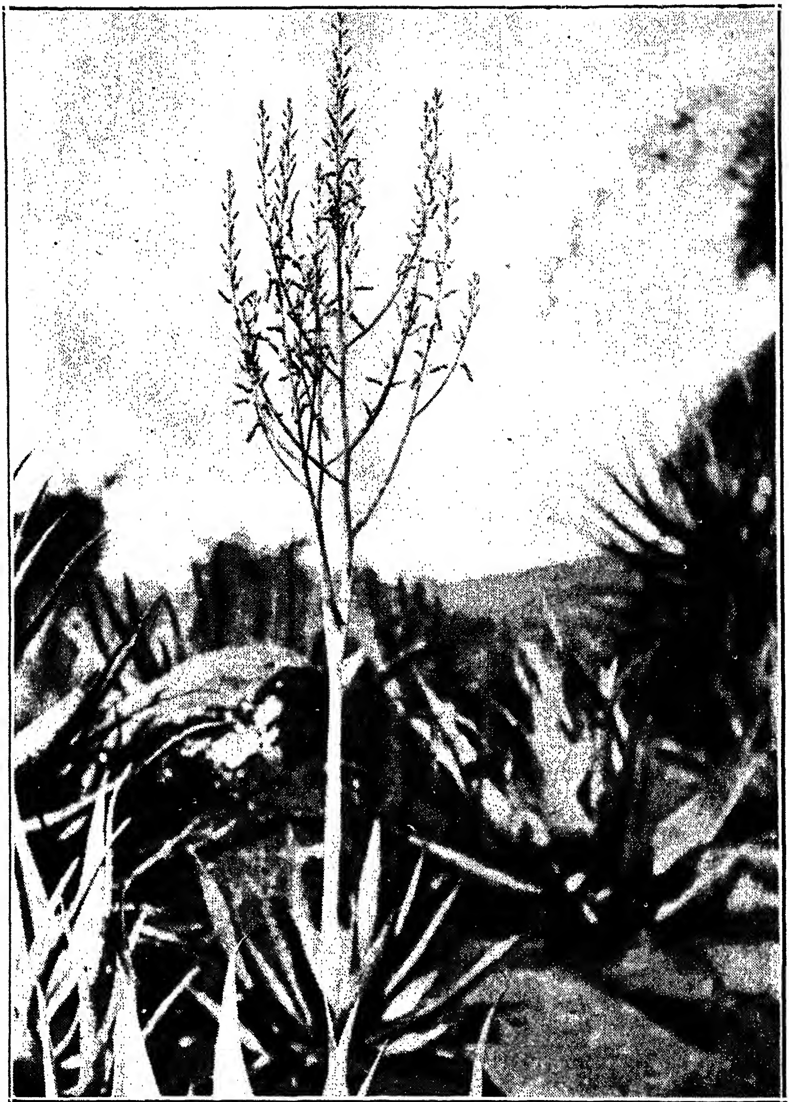
Leaves in a dense rosette, spreading recurved, somewhat fleshy, channelled above, convex below, light green or sometimes entirely red above, glabrous, 45 to 60 c.m. long, 6 to 8 c.m. broad, with reddish margin and armed with small pink cartilaginous thorns 1 to 1.5 m.m. long and 7 to 10 m.m. apart.

Scape simple, laterally compressed, dark reddish-brown, about 60 to 75 c.m. long, provided with numerous oblong-deltoid, light brown, scarious empty bracts, mostly 3-nerved, raceme 25 to 30 c.m. long, very densely multi-flowered; bracts ovate-cuspidate, scarious, 3-nerved, 10 m.m. long, 7 m.m. broad, flowers sessile, campanulate-cylindrical, flower-buds pale reddish brown, striped with green at the tips.

Perianth 14 m.m. long, segments free, outer 5 m.m. broad, spathulate, flesh-coloured with three longitudinal dark nerves inner 8 m.m. broad yellowish at the edges and with a reddish or greenish median line.

Stamens and style protruding 8 to 10 m.m. beyond the perianth.

A. sessiliflora.



A. zebrina.

Capsule enwrapped with dry perianth, small, cylindrical-oblong, 9 to 10 m.m long. ·Seeds triquetrous, greyish, very narrowly winged, 3 m.m. long.

Aloe Zebrina.—*Aloe zebrina* occurs right across tropical Africa from Angola to Portuguese East Africa. It is widely distributed over Southern Rhodesia on both the granite and red soils, in open grass veld and on the kopjes. Under cultivated conditions it reproduces itself by means of underground runners, but I have not noticed this habit in its wild state. It is one of the acaulescent or sub-acaulescent spotted leaf aloes, leaves green with longish pale green oblong blotches arranged in irregular more or less transverse bands on upper surface, lower surface pale green with more or less distinct darker green linear markings. Inflorescence about 4ft. high, one or two from same rosette of leaves. It flowers in February and March.

Description: Al Berger; Das Pflan.

Acaulescent or with a short stem, suckering.

Leaves, 15 to 25, densely rosulate, linear-lanceolate, from the middle acuminate, 15 to 30 c.m. long by 6 to 7 c.m. broad, flattish above, sub-canaliculate towards the apex, convex below, fleshy, dark green, often becoming purplish in the young state, powdery-glaucous all over, particularly below, striate, marked with large more or less numerous spots often confluent and irregularly transverse, sinnuately toothed on margins, with horny deltoid teeth, brown at the points, strong, 6 to 7 m.m. long and 10 to 16 m.m. apart.

Inflorescence about 1.00 m. to 1.60 m. high, peduncle copiously branched above the middle, branches erecto-patent, ending in lax racemes up to 30-40 c.m. long; bracts 10-12 m.m. long, linear-lanceolate, cuspidate, 3-5 nerved; pedicels about 6 to 7 m.m.. long; perianth 30 to 35 m.m. long, dirty-red, tube strongly inflated around ovary, from there conspicuously constricted and decurved, ampliated towards the throat, lightly compressed laterally, with the lanceolate segments twice as long, the outer acute, many-nerved, the inner more obtuse and broader; filaments included.

Seeds about 7 m.m. long; broadly winged, brownish.

EXPORT OF FROZEN PORK FROM SOUTHERN RHODESIA.

By A. E. Romyn, Senior Animal Husbandry Officer.

There has been sporadic talk of the export of bacon or pork from Southern Rhodesia for some time past, but no active measures have been taken to get the trade started.

The export parity has, up to the present, generally been so far below the local value of the product that the general feeling has been that sufficient pigs would not be forthcoming, at the price which would probably be realised from export, to justify any vigorous propaganda in favour of export. A recent temporary drop in the price of pigs combined with the continued low overseas price for maize have, however, again brought the matter to the fore and the present seems an opportune moment to test the overseas market with a trial consignment of frozen pork.

The letter which appears below has accordingly been sent to the Rhodesia Agricultural Union and it is hoped that the necessary arrangements for the shipment will shortly be in train.

The Secretary,
Rhodesia Agricultural Union,
P.O. Box 592,
Salisbury.

Dear Sir,

EXPORT OF FROZEN PORKERS.

A recent drop in the price of pigs on the local market has again brought to the fore the question of the export of pig products. This Department holds that the only means of achieving stability on the local market, or of developing an industry of importance to the Colony, is to build up an export trade in bacon or pork to the United Kingdom. It is

convinced that with proper organisation such a trade should return a reasonable profit to the producer.

To bring matters to a head the Department wishes to see a trial consignment of frozen pork sent to Smithfield and will undertake to guarantee a price of 3½d. per lb. dead weight, Bulawayo,* on a consignment of 500 to 600 suitable porkers. For various reasons it has been decided to make the initial attempt with frozen pork, but this does not preclude a change over to bacon later should trade conditions change.

These pigs will be slaughtered and prepared at the Bulawayo works of the Rhodesia Cold Storage and Supply Co., which has undertaken to market the pigs as an experimental consignment at an inclusive charge of 2d. per lb. The company retains the offals.

It is considered that on a basis of recent prices at Smithfield, the pigs should sell for about 5½d. per lb. This would leave to the producer a net return of 3½d. per lb. at Bulawayo.

It is desired to collect these pigs as close to Salisbury as possible so that the Department can maintain a certain amount of supervision of the type of pig selected and the method of feeding. I have accordingly to enquire whether your Union would undertake the collection of a consignment of suitable pigs.

It can be pointed out to your members that the future of the pig industry lies in export and that the return that will be paid to participants in this consignment represents the full market value of the pigs overseas. Incidentally the removal of these pigs will tend to stabilise prices on the local market. In the event of the pigs selling for more than 5½d. per lb. the extra return will be paid to the producer.

The Cold Storage will arrange to combine the shipment of this frozen pork with a consignment of frozen beef or mutton so as to accommodate the small quantity involved. The Company will, however, require fair warning of the date of shipment and arrangements will have to be made to get a consignment together which can be marketed in the course of not more than two weeks. It is suggested that, if your Union

* The guaranteed price has subsequently been raised to 4d.

favours the scheme, you should arrange for the delivery of the pigs at Salisbury or Bulawayo within a definite period of two weeks set well ahead. The Department will be glad to give you all assistance possible in the organisation and timing of the collection and despatch of the pigs.

The type of pig desired is a porker, 90 to 110 lbs. live weight, not over 4½ months of age. For this first consignment it should be progeny of a pure bred boar of any one of the recognised breeds out of a roomy sow of improved type and not necessarily of any special breeding. It is suggested all sows and/or young pigs should be inspected by the Senior Animal Husbandry Officer before they are accepted for the consignment.

The matter of feeding is of great importance. It must be laid down that—

(a) no sunflowers or monkey nuts are used;

(b) the quantity of succulence of the nature of sweet potatoes, majordas, pumpkins, etc., is limited;

(c) either separated milk or blood meal is provided for the young pigs.

It is recommended that the basal ration should consist of maize and separated milk or blood meal plus a sufficient quantity of green feed. One third to one half of the maize ration can with advantage be replaced by barley meal, cowpea meal, pea meal, kaffir corn meal or one of the native millets, either singly or in combination.

The young pigs should get a full grain ration varying from 1 to 3½ lbs. per head per day, depending on their age and size.

If desired specific advice on feeding can be given in each case.

To economise railage and book-keeping the larger the individual consignments, the better, but it is understood from the Railways that no objection will be raised to the erection of temporary partitions in the trucks en route to Bulawayo so as to allow small lots to be kept separate where necessary.

There are numerous matters of detail which will occur to your Association which can be discussed later. At this stage the Department is anxious to learn definitely—

(a) whether the necessary pigs will be forthcoming;

(b) when would be the most suitable time to arrange for the shipment.

Yours faithfully,
H. G. Mundy,
Acting Secretary,
Department of Agriculture and Lands.

The intention is to ship 500 to 600 pigs so as to make up a consignment of sufficient size to draw some attention on the market. The export rate of 2d. per lb. quoted by the Rhodesia Cold Storage and Supply Company compares favourably with the charges from New Zealand and the results of the consignment should, therefore, give a fair indication of the economic value of our product on the London market. The proposition seems as good a one as can be made under the circumstances. It then remains to be seen whether producers will respond to the prices realised.

The type of porker required has been set forth in the body of the letter. Pigs of this weight dress about 70 per cent., which would give the optimum weight of carcase desired of 60 to 80 lbs. For reasons given later, it is not desired to concentrate on a pure porker type at this early stage. Under the present arrangements pigs not exported as porkers can be carried on to bacon weights.

The feeding of sunflower and monkey nuts is banned on account of the softening effect of those feeds on the fat. The quantity in succulence is limited to prevent the production of "pot bellied" porkers and to secure a maximum rate of gain. The weight required should easily be achieved in the 4½ months laid down, but to ensure a satisfactory rate of gain it is recommended that either separated milk or, if milk is not available, blood meal in a suitable proportion should be fed to the young pigs. The quantity of purchased blood meal is small and should not exceed 20 lbs. per pig.

In general, for maximum gains, it takes one gallon of milk to supplement 3 lbs. of maize meal, or, in absence of milk, 8 lbs. of blood meal to 92 lbs. of maize.

One per cent. of salt should be added to the grain ration and, when separated milk is not available, two per cent. of bone meal as well. It is a good plan to give pigs access to limited quantities of wood charcoal.

Some points in this letter may need explanation.

Frozen pork has been chosen in the initial consignment chiefly on economic grounds. At the beginning of February last the average price of New Zealand frozen pork at Smithfield was 6d. per lb. as compared with 50s. per cwt. for green Canadian bacon with which the Rhodesian product would compare. At these prices pork is the more profitable product to export.

It is very difficult to transport mild cured bacon from here to England. The bacon has consequently to be "hard cured" which depreciates its value.

It is easier to produce satisfactory pork from maize than good bacon from the same feed.

On the other hand pork is a more speculative commodity than bacon. The demand for pork in England is more limited than for bacon and is to a certain extent seasonal. Consequently, if the price of bacon relative to that of pork improves in the future, as is likely, it may be found more profitable to export frozen baconers, to be made into bacon in England, or cured green bacon, than porkers. This is, however, a matter for the future.

EXPERIMENTS WITH TSETSE FLY TRAPS AGAINST *GLOSSINA MORSITANS* IN SOUTHERN RHODESIA.

By R. W. Jack, Chief Entomologist.

Reports of successful trapping of tsetse flies (*Glossina pallidipes*, Aust.) in Zululand by Mr. R. H. Harris in the year 1930 led to experiments being conducted in Southern Rhodesia with traps against the Common Tsetse (*Glossina morsitans*, Westw.).

At first, owing to Mr. Harris' intention to patent his trap, no information concerning its principle or construction could be obtained and the writer was, therefore, obliged to start the investigation on a completely independent basis.

The fact that tsetse flies have long been known to be more or less shade-loving insects led to trial of traps constructed on the principle of attracting the flies into a shady enclosure and preventing their escape by further attracting them from the dark into a light portion of the trap. Two models were constructed on this basis before the publication in September, 1930, of Mr. Harris' application for patent rights in Southern Rhodesia afforded the opportunity of studying the construction and principle of his trap.

Although the construction was different the general principle of the writer's traps was obviously very much the same as that utilised by Mr. Harris.

In November, 1930, the writer visited Zululand on the invitation of the Natal Provincial Government and was privileged to see the Harris trap in action against *pallidipes*.

The demonstration was decidedly impressive and there is no doubt that the Harris trap is highly efficient against that species of tsetse fly under Zululand conditions.

From and including the year 1930 a number of different models of traps, including several of the typical Harris type, have been tested against *morsitans* in this Colony and a number of very interesting facts have emerged.

It is hoped shortly to publish in the scientific Press a comprehensive paper dealing with these experiments and the deductions they have led to, but a brief summary of the more salient points may be of interest to the readers of this journal.

In the first place it was found that none of the models attracted *morsitans* in the locality of the tests in anything approaching the same numbers as the Harris traps attract *pallidipes* in Zululand. It may be stated that this has also been the experience of investigators in Nyasaland, Tanganyika, Nigeria and elsewhere.

It was also found that meteorological conditions greatly influenced the attractiveness of the traps to *morsitans*, the results being much better in warm, dry weather (August, September and to a less extent October) than in either cool, dry weather (May, June and July) or in the wet season. In fact during three quarters of the year the catches were more or less negligible.

A further discovery referred to the colour of the main body of the trap. Harris' traps are covered with hessian and the first models of this trap tested in the Colony were covered with this material. These traps gave poor results. It was found, however, that substitution of dark blue or black greatly increased the catch. Incidentally a black or dark blue *screen* was found to constitute a great attraction, being far more attractive than a range of other colours, including khaki, tested. Khaki had previously been regarded as probably the most attractive colour to this species, but it made a very poor showing in these tests in competition with the dark blue and black. A dark blue screen in fact attracted considerably more tsetse flies than a live donkey.

Another point which was quickly obvious was that the flies would attack man or be attracted to a moving car in numbers under meteorological conditions which rendered the traps practically inoperative.

It has been generally considered that an oblong trap like the Harris trap or an oblong screen attracts tsetse and other flies because to the eyes of the insects it more or less resembles an animal or source of food.

The experiments conducted appear to demonstrate very clearly that this is not the case.

It should be noted that the body of the Harris trap has the sides sloping inwards from top to bottom, so that at least one side is in shade and frequently both. When Mr. Harris first experimented with these traps the sides were vertical and this trap did not give the same results as the models with the sides sloping inwards.

The writer's deduction from available data is that the attraction to all these traps is altogether independent of any resemblance of the traps to animals, that in fact it is not a food reaction at all, but a reaction to shade. Attraction to shade is presumably a visual reaction, and a dark patch, whether composed of actual shade or of a dark coloured screen, should have the same effect on the eyes of the fly. The interior of the first two models of traps constructed by the writer was painted dull black and was very dark indeed, with no light visible beyond. Under suitable conditions the flies would make their way into these traps through a slit as narrow as one quarter of an inch, a striking demonstration of their strong tendency to enter dark places.

The fact that flies were attracted strongly to moving man and vehicle at a time when they were hardly attracted to the traps at all appears in itself a sufficient proof of the difference in the attraction. Full-fed flies were also caught in the traps and these certainly could not have been seeking food.

Tsetse flies are forest insects. They are shade loving (sciaphilous). Being shade loving they are also shade seeking (sciatropic). Some species are, however, more shade loving than others. This attribute would appear to be correlated with the degree of ability of the particular species to resist desiccating influences. *G. pallidipes* is a species which apparently needs thickets in its habitat. It is presumably more shade loving or shade needing than *morsitans*. It occurs in some places in dense forest which *morsitans* definitely avoids. *Pallidipes'* association with thicket indicates a special

attraction to low patches of shade on the landscape, whereas the shade cast by the open forest trees, with which *morsitans* is associated, has a different appearance to the eye.

It appears probable that the relatively weak attraction exercised by the Harris traps on *morsitans* in comparison with *pallidipes* is due to these two factors, namely—(1) less need for entering shade frequently during the greater part of the year and (2) less attraction to the particular type of shade presented by the traps.

In either cool or wet weather, when the rate of evaporation is low, *morsitans* does not appear to be very strongly shade seeking and these conditions are also associated with a superabundance of shade in the forest. As the evaporation rate increases *morsitans* finds frequent shade more necessary and these conditions are associated with leaf-fall and diminished shade. It is under these conditions that the traps are most attractive. It may be noted that from Mr. Harris' published records the traps function better against *pallidipes* in Zululand when the wind is from a dry quarter (north) than a wet quarter (south). Mr. Harris' "dummies" from which his traps were developed apparently exercised no attraction on *pallidipes* in cloudy weather.

It would seem that in order to confine themselves to the forest tsetse flies must be guided in their flights by something which is confined to forest and the picture is that they consistently fly from one patch of shade to another. As far as *morsitans* is concerned if the weather be cool or humid the shade-seeking tendency is probably weak, but sufficient to keep the flies from wandering into the open far from the forest. A highly evaporating environment such as prevails in the latter part of the dry season, however, makes them much more dependent upon shade and their ranging flights under these conditions are probably strictly controlled by the occurrence of patches of shade in reasonably close proximity to one another. They keep to forest still in foliage at this time of year.

The shade-seeking nature of the fly's movements is more or less generally recognised in the fact that clearings are regarded as more effective barriers if forest is not visible on

the further side. Under certain conditions the fly will, however, cross quite a wide open space if there is a shady objective in view.

Attraction to an object casting a horizontal shade may incidentally lead a tsetse fly to a source of food, such as a large quadruped, but there is little doubt that at least in the case of *morsitants* the primary hunger reaction from a distance that is the *visual* reaction is towards *movement*. A hungry fly is very strongly attracted to any moving object, be it man, animal or vehicle. For this attraction the term *kinetropism* is suggested. It is usually a stronger attraction than shade to hungry flies and also to the non-hungry males of *morsitans*, but is generally considered to be in abeyance in the case of non-hungry females. Under conditions of an excessively high evaporation rate, such as occurs in the hot October days, however, the need for shade is stronger than the desire for food and even very hungry flies may fail to be attracted to moving objects under these conditions.

From short distances hungry flies are probably attracted also by *scent*.

Under these circumstances it should be comparatively easy to devise a trap on the basis of *movement* which would catch *morsitans* in large numbers. It is, in fact, reported that this has been achieved in Tanganyika Territory. Movement, however, means power and even using the wind as a source of power it would hardly be possible to make such traps in large numbers very cheaply. Moreover, experience during the past season in trying to use arsenite of soda powder as a dust against locust swarms has shown what long periods may occur in this Colony without sufficient wind even to distribute a fine powder. During the wet season especially, traps needing wind for their operation would be liable to stand idle for considerable periods.

There is a considerable number of very interesting deductions from the experience with shade traps in this Colony, but it is not proposed to deal in this short article with more than have been summarised above.

The practical point is that the Harris trap and traps acting on the same principle have not proved of any real use against *morsitans* in Southern Rhodesia and, if the

writer's deductions are correct, a totally different principle will need to be used if success is to be attained in trapping this species.

Finally, it may be pointed out that, whilst a really effective trap would undoubtedly be very useful in getting rid of tsetse flies in a restricted habitat, as for instance the sleeping sickness tsetse, *G. palpallis*, which is confined to lake shores and river banks, or such tsetse flies as *morsitans* and *pallidipes* in sufficiently limited areas isolated from invasion by flies from without, its usefulness in connection with the problem in this Colony is not so obvious. Unfortunately, in Southern Rhodesia, although some six districts are more or less involved, there is now only one vast fly area, within which the distribution of the insect is practically continuous, at least during the wet season and first half of the dry season. To use traps effectively it would probably be necessary artificially to isolate the portion of the fly area to be dealt with and feasible means of doing this are at present still to seek. The prospect of bringing about retrogression of the fly over a wide front by any form of trapping, or of stopping the general spread of the pest, which involves a front of about 600 miles, by such means alone appears very slight.

LOCUSTS

INSTRUCTIONS FOR DEALING WITH FLYING SWARMS.

By the Division of Entomology.

Flying locusts constitute a serious menace to farmers and ranchers. The majority of red and migratory hoppers which have escaped destruction in Southern Rhodesia will become fliers while crops and pastures are still green enough to attract them, that is, from the middle of March onwards. Swarms of flying red locusts bred both in Southern Rhodesia and beyond our borders will, no doubt, continue to traverse the Colony throughout the dry season and constitute a potential threat to winter crops and grazing. The only practicable procedure is for each farmer to prevent the locusts as far as possible from settling on his lands, or, if they have settled, to drive them off.

Scaring.—Scaring methods, while primitive, are frequently very effective, although an egg-laying swarm may be difficult to dislodge; however, the red locusts are not expected to lay eggs during the dry season, and the behaviour of the migratory locust is uncertain. Banging of tins and creating disturbance by other means such as discharging of firearms, waving of brightly coloured flags, etc., where the locusts threaten to settle or have settled will usually be sufficient to drive them away.

Smudge Fires.—Materials for producing quick smudge fires and maintaining these for some hours should be kept in position around the lands, with special attention to the side towards the prevailing winds. Further material, which, on burning, gives off a dense and pungent smoke, should be placed in readiness when swarms are believed to be approaching. Green wood with leaves attached and wet straw

are useful materials for placing on the fire when it has been lighted, but, of course, any other suitable material that is available can be used.

The fire should be lighted on the leeward side, and fresh green and moist material piled on top on the windward side as the fire burns. Combustion should be slow, and on no account should flames be allowed to break through the wet blanket on the top. A properly constructed fire should burn slowly for several hours. The best form for a smudge fire is probably a long low heap, with the long axis parallel to the line of the prevailing wind. A round pile will probably break into flames too readily.

The addition of heavy petroleum oil, spent lubricating oil, coal tars, etc., to a smudge fire will greatly increase the column of dense smoke. The oil should be applied on the wet material in small quantities on the windward side.

Kenya Method.—In Kenya a very satisfactory smoke screen has been produced by injecting waste oil into the exhaust box of an internal combustion engine, tractor, etc. This method, it is stated, "has the advantage of delivering a continuous curtain of smoke and can be applied on the most suitable line according to the direction of the wind at the time." It also eliminates the risk of firing crops.

The following directions for making smoke screens from an internal combustion engine are given by the Department of Agriculture, Kenya:—

"The exhaust manifold is drilled and tapped to take a small cock into the end of which is brazed 8 in. or 12 in. of about 5-16 in. copper tubing. The purpose of this is to keep the rubber tubing which leads to the fuel supply insulated from the heat of the manifold. The fuel supply can be either of two types: (1) Gravity feed; (2) forced feed.

"(1) The gravity feed is the simpler, and consists merely of a four-gallon drum or any other receptacle strapped to the tank or any other convenient part of the tractor. The rate of feed can, of course, be varied to some extent by adjusting the height of the fuel container above the point of injection into the manifold.

"(2) The pressure system consists of two four-gallon drums connected by a piece of copper tubing, with a cock at the centre. One drum, the fuel container, has a delivery pipe at the bottom, while the other, the air pressure container, is fitted with an ordinary motor-tyre valve. Pressure is created in the air container by means of an ordinary motor tyre pump, only a few pounds being required. By opening and closing the valve between the two containers the amount of fuel delivered to the manifold can be adjusted for the maximum volume of smoke.

Method Preferred.—"The method described in paragraph (2) is considered preferable to that in paragraph (1), as the rate of injection can be adjusted at will.

"The following points should be noted: (1) Do not drill the manifold in such a place that the fuel on being injected would tend to come into connection with the carburettor heating system. (2) In the pressure system all joints must, of course, be airtight. (3) The tractor must be thoroughly hot before the injection is made. (4) In order to keep the tractor hot while the screen is being laid, it should be kept on load, if possible, by pulling such an implement as a disc harrow."

Chemical Smudges.—The following formula for a chemical smudge has previously been recommended:—

Saltpetre	30 parts
Sulphur	12 parts
Borax	8 parts
Coal tar	25 parts

The saltpetre, sulphur and borax should be in fine powder or should first be ground; they should be thoroughly mixed, and then added to the tar (warmed if necessary) and thoroughly incorporated therewith.

A deep tin, such as a jam or coffee tin, should be filled three-quarters full of the tar mixture, and on top of this should be placed a layer of about a quarter-of-an-inch deep of priming mixture of the following composition:—

Saltpetre, sulphur and borax mixture as above	2 parts
Sugar, fine white	1 part

In compounding this mixture, it is essential that the saltpetre should be thoroughly dry; it is apt to absorb moisture from the air, and should therefore be dried in an oven and allowed to cool before mixing. In the centre of the priming composition a small quantity (just a pinch) of chlorate of potash (finely powdered) should be sprinkled, as this will enable the mixture to be ignited without any trouble. A few strings of cordite or some gunpowder out of a cartridge could be used instead for this purpose, or a blowlamp can be used for igniting the mixture. As soon as the priming composition is ignited, a lid of some sort can be put over the tin loosely. The priming mixture should burn fiercely, and in about 30 seconds a dense smoke should be produced; an ordinary jam tin, holding 1 lb. of mixture, will burn for about 12 minutes. If the mixture bursts into flame, a few handfuls of sand should be thrown over it to stifle the flames. There is no likelihood of it being extinguished when once fully ignited. It is of the utmost importance that the priming composition should be thoroughly dry.

Storing Mixture.—If quantities of the mixture are to be prepared some time in advance to meet possible emergencies, the two mixtures should be stored separately in airtight containers such as coffee or syrup tins, or in bulk in larger airtight containers. Should the mixture deteriorate it can still be put to some use by throwing it on to a smudge fire.

Another recommended formula consists of the following materials:—

Five-gallon drum coal tar.
100 lbs. bag of nitrate of soda.
50 lbs. sulphur.
25 lbs. borax.

This quantity is sufficient to fill 100 one pound coffee tins, and each tin should burn for 15 minutes.

These substances should be mixed as follows:—

Ten pounds of nitrate of soda should be taken out and kept in a dry place, the remainder, if damp, should be gently dried in an oven.

Powder the whole of the sulphur and borax and then mix thoroughly with the 90 lbs. of nitrate of soda. The latter need not be powdered but the lumps should be taken out.

Do not Grind these Three Materials Together.—Add the nitrate, sulphur and borax mixture to the tar and stir thoroughly. An eight gallon petrol drum with the top removed would be a convenient receptacle for the mixture.

Three-quarters fill small tins from the bulk. Any small tin will do, but deep ones (e.g., 1 lb. coffee tins) are probably best. If the tins have lids, these should be pierced with nail holes; if they have not, a larger tin should be perforated and placed over the smaller tin containing the mixtures.

When required the tins should be placed out at intervals of 25 yards, and a small quantity, about a tablespoon of the dry nitrate of soda from the 10 lbs. originally reserved, should be put on the top of the mixture in each tin.

If the swarms appear likely to alight, ignite the priming mixture of nitrate of soda either with a blowlamp or with a fuse igniter.

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THE CONSTRUCTION OF DIPPING TANKS.—II.

By B. G. Gundry, A.I.Mech.E.; and Notes on their Management, by J. M. Sinclair, M.R.C.V.S., Chief Veterinary Surgeon.

A MASONRY DIPPING TANK (Fig. 2).

Where suitable building stone is abundant a masonry dip tank can be built far more cheaply than one of concrete, especially where the quarrying, dressing and carting of the stone can be made a spare time job for natives, who, for various reasons, have to be kept on the pay roll but cannot always be profitably employed.

Preparation of Stone.—In many localities granite or dolorite can be found in the form of slabs or layers of varying thickness that have split off larger bodies of rock. These can be cut into suitable size blocks. Where it is necessary to split large bodies of rock the following method is usually employed. A line of holes about 1 inch diameter and 3 to 5 inches in depth is drilled with a jumper at intervals of 4 to 8 inches along the line of cut. Into each of these holes is placed a steel wedge or "feather" with its larger end at the bottom of the hole. A tapered steel plug is then driven in beside the feather with a heavy hammer. All the holes are plugged in this way in the afternoon when the rock is comparatively warm. During the night the rock cools down, contracts and splits along the line of holes. Some experience is required, however, to determine the direction of the grain, or planes of cleaverage along which the rock will split most easily.

The size of the blocks used may vary considerably, the weight that can be conveniently handled being really the limiting factor. A stone 18 inches long by 9 inches wide and

6 inches thick weighing about 100 lbs. would be a very fair maximum. Stones less than one-third of this size should only be used occasionally where necessary for filling in between the larger ones. It will be readily appreciated that less cement will be required to lay large well-shaped stones carefully fitted together than small or ill-shaped ones requiring large quantities of mortar to fill very numerous or ill-shaped joints.

Excavation.—The excavation must be taken out to the exact dimensions shown in the drawing, so that no back filling behind the masonry is necessary. The floor and outslope must be rammed all over to ensure that there are no soft spots. The shelves on which the foundation of the splash walls rest must be cut down until a thoroughly compact formation is reached. If a sound footing cannot be found at a reasonable depth it may be advisable to complete the walls of the tank itself and build the splash walls independently so that if they do subside no damage will be done to the former.

Construction.—Great care should be exercised in selecting the stones for the floor and outslope, which must be laid first. They should be of a uniform thickness of about 6 inches, and as large in area as possible. They must be laid on a thin layer of sand, and each stone must be hammered all over with a small wooden log until it is absolutely rigid.

A space of about half an inch should be left between adjoining stones. A liquid grout of 1 part cement and 4 parts sand should afterwards be poured into these joints until they are half full, and the remainder of the spaces immediately filled by working in a stiffer mixture of 1 part cement and 3 parts sand with a small trowel.

The side and end walls should be laid hard up against the face of the excavation, but where, for any reason, this cannot be done, any spaces left must be carefully filled in with sand and tamped solid as the work progresses.

In the drawing, the sides of the excavation are shown vertical, but there is no objection to cutting them to the same slope as the inner face of the wall and making the

stone work a uniform thickness of 18 inches throughout to the level of the footing of the ledge.

The type of bond recommended for the walls is known as "squared rubble," and is illustrated in the drawing of the wall of the dripping pen in Fig. 2.

It will be noted that the upper and lower edges of each stone are parallel and are laid horizontally and the vertical joints are kept as short as possible. The bonding across the thickness of the wall is most important, and either "through bonds," extending from one side of the wall to the other, or "headers" extending about two-thirds of the way through the wall and crossing each other alternately from opposite sides should be laid 4 or 5 feet apart in each course. The practice of dressing off the ends of these or any other stones after they are laid should not be permitted. Each stone must be laid on its natural bed, i.e., with its grain or natural lamination lying flat.

The walls must be properly bonded throughout their thickness. Some builders are content to lay the face of the wall with proper bonds and fill in behind in a careless and haphazard manner. Such methods should not be tolerated in a job of this sort.

The progress of the walls should proceed uniformly, the height of no single portion exceeding the remainder by more than 2 feet.

All the walls of the tank itself, up to the level of the ledge, should be laid in cement mortar consisting of 1 part cement, 4 parts sand and ½ part lime paste. In order to avoid delay in using each batch of mortar all the stones for each course should be selected, dressed and fitted first before the mortar is mixed; the actual laying is then a straightforward job. The splash walls above the ledge and the walls of the entrance race may be built in ordinary lime mortar or even dagga, provided the joints are all properly pointed with cement mortar. The foundations of the walls of the entrance race should in either case be laid in lime mortar, to which about 10 per cent. of cement has been added immediately before use.

Plastering.—If a tank is built with large well-shaped stones and the faces of the walls are evenly finished and the joints are properly made with the mixture recommended, it is not necessary to plaster the interior of the tank. If, on the other hand, comparatively small stones are used and the joints are consequently numerous, plastering is advisable to ensure water tightness. Cement does not adhere too readily to a stone surface, and it is very advisable to rake out the cement joints in the masonry to a depth of 1 inch to provide keys for the plaster. This must be done as the work proceeds, since the mortar will have set too hard to remove later. The plaster used below the level of the ledge should consist of 1 part cement, 3 parts sand and ¼ part lime paste. For plastering the splash walls above the ledge and the walls of the entrance race a mixture of 1 part cement, 5 parts sand and ½ part lime paste may be used. All the plastering must be applied in one coat not less than ½ inch thick, and the interior of the tank itself should be completed in one day. The plaster should be worked to an even surface with a wooden float and given a final polish with a steel trowel or float, but this operation must not be overdone, or hair cracks may develop. The plaster must be carefully cured as previously described. The tank may be filled as soon as convenient after the plaster is sufficiently set.

MASONRY DIPPING TANK.

Quantities of Materials.

Item.	Description.	Quantity.
Stone	For building tank only up to level of ledge	49 cu. yds.
Stone	For splash walls and walls of entrance race	20 cu. yds.
Cement	For laying masonry in tank up to level of ledge in cement mortar (1 cement, 4 sand, ½ lime paste)	49 bags.
Sand	For *ditto*	15 cu. yds.
Cement	For plastering interior of tank to level of ledge in cement mortar (1 cement, 3 sand, ¼ lime paste)	8 bags.
Sand	For *ditto*	2 cu. yds.

Item.	Description.	Quantity.
Cement	For laying splash walls and walls of entrance race in cement mortar (1 cement, 5 sand, ½ lime paste)	16 bags.
Sand	For *ditto*	6 cu. yds.
Cement	For plastering splash walls and walls of entrance race with cement plaster (1 cement, 5 sand, ½ lime paste)	6 bags.
Sand	For *ditto*	2½ cu. yds.
Lime	For adding to cement mixture for all above work	13 bags.
Alternative—		
Lime	For laying splash walls and walls of entrance race in 1-6 lime mortar	7 bags.
Sand	For *ditto*	6 cu. yds.

The above estimate for the quantity of cement required for laying the stonework is based on fair average workmanship and regular joints.

A BRICK DIPPING TANK.

(See Special Section, Fig. 2.)

Most of what has already been said regarding the building of a masonry tank applies with equal force to the building of a tank in brickwork.

The same care must be exercised in making the excavation. The bricks should be laid and plastered with the same mixture. The inside dimensions are the same and only minor alterations in the external dimensions are shown in the special section of a brick tank. (Fig. 2.)

Only really sound, thoroughly well-burnt bricks are suitable for such work. To make a rough test of their suitability, soak a few of the bricks in water for at least 24 hours. At the end of this period, although they will have absorbed a considerable quantity of water, they should not show the slightest signs of disintegrating, and they should break with only slightly less effort than when dry.

The use of bricks, however good, is not recommended for the floor of the tank, and still less so for the outslope. Unless sufficient stone is obtainable to lay the floor as directed in the case of a masonry tank, concrete should be used for this purpose.

The first two courses of the brick walls should be laid along either side of the excavation so that a space of 3 feet is left between them in which the concrete floor is laid. Two planks can be used as shuttering to retain the concrete floor on the outslope, or two courses of brickwork may be laid temporarily either dry or in dagga to serve the same purpose. The width of the concrete at the top of the outslope will be 5 feet 9 inches.

As soon as the floor has set, the walls of the tank can be built, the bricks being laid in alternate courses of headers and stretchers. All bricks must be soaked in water for at least 5 minutes immediately before being laid.

In the drawing, the sides of the excavation are shown vertical, but, if preferred, they may, as mentioned in the case of the masonry tank, be excavated on the slope to the same angle as the inner faces of the walls and the brickwork kept at a uniform thickness of 18 inches throughout. If this is done the courses of brickwork should be kept horizontal, but staggered or stepped back so that the outer bricks are all hard up against the face of the excavation. The objection to this method of building is that far more care and skill are required in making the excavation exactly the correct shape and size, since it is important that no back filling be necessary.

The splash walls may be laid in lime mortar or dagga, but, in either case, they must be plastered, at least on the inside.

Since bricks are porous the water-tightness of the tank depends entirely on the plaster, and it is advisable to make the coating not less than ¾ inch thick.

The walls must be cleared of all loose dirt and particles of mortar and well wetted before the plaster is applied. Careful curing of the plaster is essential.

BRICK DIPPING TANK.

Quantities of Materials.

Item.	Description.	Quantity.
Bricks	For building tank only up to level of ledge	16,500
Bricks	For splash walls and walls of entrance race	5,800
Cement	For laying all brickwork in tank up to level of ledge in cement mortar (1 cement, 4 sand, ½ lime paste)	46 bags.
Sand	For *ditto*	14 cu. yds.
Cement	For plastering interior of tank as above with cement plaster (1 cement, 3 sand, ½ lime paste)	8 bags.
Sand	For *ditto*	2 cu. yds.
Cement	For laying splash walls and walls of entrance race in cement mortar (1 cement, 5 sand, ½ lime paste)	13 bags.
Sand	For *ditto*	5 cu. yds.
Cement	For plastering splash walls and walls of entrance race with cement plaster (1 cement, 5 sand, ½ lime paste)	6 bags.
Sand	For *ditto*	2½ cu. yds.
Lime	For adding to cement mixture for all above work	12 bags.
Cement	For concrete floor	6 bags.
Sand	For *ditto*	1½ cu. yds.
Crushed stone	For *ditto*	3 cu. yds.
Alternative—		
Lime	For laying splash walls and walls of entrance race in 1-6 lime mortar	7 bags.
Sand	For *ditto*	5 cu. yds.

REINFORCED CONCRETE TANKS.

The construction of a reinforced concrete dipping tank would usually be more expensive than one of plain concrete; moreover, it is highly skilled work, and therefore hardly comes within the scope of this article. Generally speaking, this method of construction is only employed when a tank has to be built on treacherous ground.

SHEET IRON DIPPING TANKS.

Dipping tanks built of thin sheet iron, which may be obtained in sections ready for erection on the farm, may in special circumstances find favour on account of their being more or less portable. Their cost does not, however, compare very favourably with one built of stone or brick under normal conditions, and their durability would be uncertain.

Alterations and Modifications.—Various modifications may be made to the foregoing recommendations where circumstances call for their adoption. For instance, where only small stones are available a masonry tank can be built with a concrete floor in the same way as suggested in the case of the brick tank.

Brick splash walls may be superimposed on a concrete or masonry tank.

Steel rails or pieces of old tyre iron may be set in a concrete outslope in place of the moulded concrete steps.

Expert opinions differ as to the advisability of providing steps at the end of the entrance race, and these can be omitted if desired.

If cattle attempt to jump on the side ledges in an effort to avoid the plunge, short wooden hurdles can be placed so as to prevent this, or the ledge may be built up to a higher level for a few feet along its length, but such obstacles must not defeat the object for which the ledge is intended, i.e., to enable those in charge to control the animals in the dip.

The use of lime or dagga as a substitute for cement in building masonry or brick tanks cannot be recommended. Admittedly many tanks have been built with such materials and have proved successful for varying periods of time, but

their permanence is very doubtful and such construction must be regarded as a gamble by those who, from choice or necessity, are prepared to adopt it.

NOTES ON CONTRACTS.

A written contract or agreement, however carefully drafted, may prove of little value in dealing with an incompetent or unscrupulous contractor, and a farmer will be well advised to employ one whose ability and integrity are well known. It is advisable even then to have some agreement setting forth the responsibilities and obligations of both parties, and the following notes may be found useful in drafting such an agreement.

It should be stated:—

(a) Who the responsible contracting parties are.

(b) The time by which the work is to be commenced and finished. When urgency is an important matter a clause may be inserted under which the contractor forfeits a definite sum for every day he exceeds the specified period, but it must be distinctly stated that such sum is by way of "liquidated and ascertained damages and not by way of penalty."

(c) The nature and amount of labour to be provided by each party.

(d) Who is responsible for any transport required for plant or materials, etc.

(e) What tools and plant are to be provided by each party.

(f) What materials are to be supplied and/or prepared by each party. The item in this clause likely to give trouble is the quantity of cement. If the contractor undertakes to supply it he may skimp the job in order to economise. On the other hand, if the employer supplies it, the contractor may demand an unreasonable quantity, and if refused, either decline to accept any responsibility for making a sound job, or, after using all the cement supplied, demand more with which to finish the job. Constant supervision is necessary in either case.

(g) Who is responsible for the care and the safety of the plant, materials and work in progress against theft and inclement weather.

(h) What drawing and specification is to be worked to. Any modification to the drawing as printed should be specifically detailed. The employer should be able to extract from this article such information as is required to specify how the work is to be performed. The specification should include a clause setting forth what test shall be accepted as indicating that the tank is water-tight.

An arbitrator, whose decision, in the event of any dispute, will be accepted as final and binding by both parties, may be named.

(i) That any alteration from the original drawing or specification required after the work has been commenced must be stated in writing, and any resultant alteration in the agreed price should be also set down.

(j) The amount and terms of payment for the work. It may be agreed that a small percentage of the original contract sum may be retained by the employer for a period of 3 or 6 months, after which it shall be paid to the contractor, provided that he has made good at his own expense any defects that may have developed or been revealed in the meantime.

Generally speaking, it is not good policy to make any payment or advance until the job is completed.

The agreement should be signed by both parties in the presence of one or more witnesses who should sign in that capacity.

No stamp is required on such an agreement.

NOTES ON THE MANAGEMENT OF DIPPING TANKS.

By J. M. Sinclair, M.R.C.V.S.

Hints on Dipping.—As proprietary dips are now generally used instead of the arsenite of soda or Natal Laboratory dip, it is only necessary to state that full instruc-

tions are supplied with each tin, and these should be rigorously adhered to.

In order successfully to accomplish the object for which the process is practised, viz., the destruction of ticks, it is essential that the fluid be maintained at the proper strength. If it falls below this, ticks are not destroyed, and so much time and money are wasted; if it becomes too strong, much injury may be caused to the animals dipped, and in some cases serious mortality may ensue.

The strength of the fluid is altered by evaporation or by addition of water. It is pure water only which evaporates, and evaporation, therefore, results in an increase of the strength of the remaining fluid. The addition of rain and flood water naturally causes a diminution in the strength of the fluid. A thatched roof is usual over the tank to prevent excessive alteration in the strength of the dip owing to evaporation or addition of rain water. If the following procedure is faithfully adhered to, the strength of the fluid will be maintained at, or sufficiently near for practical purposes, the proper strength. After each dipping the depth of the fluid in the tank should be accurately measured, and the result recorded in a book specially kept for the purpose; it is fatal to trust to memory in a matter of this sort, where the result may be so serious. Immediately before the next dipping the depth should again be measured, and any difference in the quantity of the fluid accurately calculated. If there has been a decrease, water alone to the extent of same should be added. If there has been an increase, dip should be added in proper quantity to make such increase equal in strength to that which is being used in the tank. On on account should this procedure be omitted, even where the increase or decrease is small, because the repetition of such must result either in the fluid becoming so weak as to be useless, or so strong as to be injurious and even fatal.

Each animal that passes through the tank takes with it a quantity of the fluid, estimated at between half and one gallon; the level of the fluid in the tank is thus gradually lowered. To make up this deficiency, water with dip in the proper proportion must be added.

The chief reason for dipping is the destruction of ticks, which are transmitters of various diseases, amongst which in cattle may be mentioned African Coast Fever, Gall-sickness and Redwater. It is, however, against the spread of Coast Fever infection by this agency that dipping is now so largely practised. But it has been found that the dipping of cattle has many other advantages. Apart from the disease-bearing capacities of ticks, it is evident that their presence on animals is a serious drawback, chiefly because of the large quantities of blood extracted, which should go to growth, or to improvement in condition, or to the increase of the milk supply. Not the least of the benefits of dipping is the reduction of the mortality amongst calves from white scour, liver disease, etc. Instances can be given where such mortality has been reduced from 60, 70 or even 80 per cent. to nil.

Apart from Coast Fever areas, where short intervals are necessary, dipping as a general measure should be practised every seven days. Fortnightly dipping, or dipping only when ticks are seen on the animals, is of very little value. This is evident when it is considered that our most dangerous ticks, i.e., those which transmit Coast Fever, only remain on an average four days on the bovine host. In many cases animals which to the eye are apparently free from ticks will on close examination be found to harbour large numbers of the larvæ and nymphal forms, especially in the ears, where some of the Coast Fever-bearing ticks are most commonly found. It should be remembered that the ticks most commonly seen are the engorging females, that the males are small, and on a beast with an average coat, not easily seen.

It is advisable to give working cattle a day's rest after immersion in the tank, but some farmers inspan them as soon as the skin is thoroughly dry. Where seven-day dipping is practised, the dipping can be carried out on the Saturday afternoon, thus giving the animal at least 1½ days to recover.

Opinions vary as to the effect of dipping on milch cows. Some assert that the quantity of milk is decreased to a large extent for 24 hours, and even longer, after dipping; others say that the effect in this respect is not appreciable.

Assuming, however, that there is a slight immediate loss, it should be remembered that there is a general increase because of the better condition of the animals as the result of regular dipping.

MANAGEMENT OF DIPPING TANKS.

In a paper entitled "Notes relating to Arsenical Dipping Fluids," by Mr. A. G. Holborow, F.I.C., Assistant Agricultural Chemist, which appeared in the *Rhodesia Agricultural Journal* of December, 1915, it is stated that "it should be an easy matter, knowing the volume of liquid in the tank and the exact strength of it, to rectify any deviation by adding water only, or dip, as the case may be, and bring the dipping fluid to any desired strength." The writer agrees entirely with this view, but his experience shows that many owners and managers of tanks find a considerable difficulty in doing so. In some cases the reason is that the capacity of the tank inch by inch is not known, or, if known, is not made use of in calculating the quantity of water or dip required to bring the liquid in the tank to the proper strength. In other cases, the quantities are calculated in a haphazard or crude manner, with the result that the strength may be so increased as to cause damage to the cattle, or so diminished as to be ineffective. The tendency in the majority of cases is in the latter direction, probably because the persons concerned, not being quite sure of their quantities, prefer to err on the side of safety.

The following notes on the management of the dipping solution and dipping tanks generally will, it is hoped, be of some assistance to stock owners.

1. At the first filling the water should be measured into the tank by a 200 gallon or other convenient measure.

2. From the 5 feet level the volume, inch by inch, should be carefully recorded and marked on the wall of the tank, or preferably on a measuring rod, which can be obtained at a small cost.

3. The level should be recorded after each dipping and again before the following one.

4. When a sample is taken for analysis the quantity of solution in the tank at the time should be accurately

estimated, otherwise it is impossible to rectify any excess or diminution of strength shown by such analysis.

5. The following example is given of correcting the strength of the solution in the tank on receipt of the result of the analysis:—

(a) capacity of tank at proper dipping level—say 4,000 gallons;

(b) prescribed strength of dip used—say, 1 to 400 gallons of water;

(c) quantity of solution in tank at date sample was taken—say, 3,600 gallons;

(d) assume analysis shows strength—1 in 450;

(e) then the 3,600 gallons in tank contain 8 gallons of dip only, instead of 9 gallons; therefore, 1 gallon of dip must be added to bring the solution up to proper strength;

(f) there remain the 400 gallons of water required to bring the volume in tank up to the proper dipping level; this requires another gallon of dip;

(g) the total quantity of dip, therefore, which is required to rectify the diminished strength of the solution in the tank, and provide for the 400 gallons of additional water added to the tank, is 2 gallons.

6. Where necessary, the tank should be protected by drains, to prevent the dip being flooded out on to the surrounding veld.

7. When not in use, the entrance and exit of kraals and draining pens should be properly secured.

8. The draining pens should be so constructed that dip cannot collect in them.

9. The drums, whether closed or not, containing the concentrated dip should be kept under lock and key.

10. When emptied, the drums should be immediately and thoroughly washed, and the washings placed in the tank or buried.

11. Where kraals are used in addition to draining pens, in order to allow cattle to drip and dry completely, cattle

should not be allowed into them until any water which may have collected in pools has been dispersed.

12. Tanks should be so protected by fencing that animals cannot have access to any ground contaminated with arsenic from splashings during dipping and leaking draining pens.

CATTLE CLEANSING ORDINANCE, 1918.

The attention of stock owners in areas in which the above Ordinance is now in force is directed to sections 5 and 6 thereof, which provide that cattle shall be cleansed by dipping at regular intervals of seven days in an "effective tick-destroying agent." An effective tick-destroying agent is defined as "an aqueous solution containing the equivalent of .16 per centum of arsenious oxide, or such other percentage of arsenious oxide or such other ingredients in such proportion as the Administrator may from time to time prescribe by notice in the *Gazette*." It is not intended to vary the percentage of arsenious oxide defined above, and to conform to this standard the following dilutions of the dips now commonly used are required:—

(1) Arsenite of Soda.
8 lbs. of arsenite of soda (80 per cent. arsenious oxide) to every 400 gallons of water.

(2) Cooper's Improved Cattle Dip.
1 gallon of dip to every 156 gallons of water.

(3) Arsenoda Cattle Dip.
1 gallon of dip to every 350 gallons of water.

(4) St. O'Gorman Cattle Dip.
1 gallon of dip to every 200 gallons of water.

(5) Cooper's Tixol.
1 gallon of dip to every 400 gallons of water.

(6) Capex.
1 gallon of dip to every 400 gallons of water.

(7) Champion Improved.
1 gallon of dip to every 300 gallons of water.

(8) Conquest.
1 gallon of dip to every 400 gallons of water.

(9) Arsenicola.
1 gallon of dip to every 400 gallons of water.

(10) Champion Improved Star.
1 gallon of dip to every 400 gallons of water.

(11) Champion Improved Special.
1 gallon of dip to every 200 gallons of water.

(12) Champion Arsenical Cattle Dip.
1 gallon of dip to every 300 gallons of water.

ARSENITE CATTLE DIP.

How to Mix.

First dissolve the arsenite in a sufficient quantity of hot water to dissolve the crystals completely. Then add water to make up to 400 gallons, stirring vigorously the while.

Although it will probably be found most convenient to dissolve the arsenite in a few gallons of hot water, this may be carried out in a short time with cold water in the following manner:—

Place two or three pounds of arsenite in a bucketful of water and stir vigorously for five or ten minutes. Allow any undissolved particles to settle, and pour off the liquid into a tank. Then add more arsenite to that remaining in the bucket and fill up with water again, repeating this till all the arsenite is dissolved.

Have proper weights and scales, and be accurate in measuring the arsenite. Always keep arsenite under lock and key as a dangerous poison. All arsenite must be completely dissolved before being added to the dipping tank.

Solutions prepared as above can be added to tanks now containing arsenical proprietary dips.

For three-day dipping:—

4 lbs. arsenite of soda (80 per cent. arsenious oxide) to every 400 gallons of water.

For seven-day dipping:—

8 lbs. arsenite of soda (80 per cent. arsenious oxide) to every 400 gallons of water.

WASTAGE OF DIP IN DIPPING OPERATIONS.

Owing to the high cost of cattle dip, the conservation of fluid by the use of adequate draining pens is a matter

of pounds, shillings and pence, and, as it will probably be a long time before prices come down to pre-war rates, tank owners would be well advised to consider the draining arrangements at their tanks with a view to reducing wastage to a minimum.

The following observations made by the Department show that proper draining accommodation means a saving of many pounds per annum:—

Tank.	Drainage.	No. of Cattle.	Wastage in Gallons.
1	Large single pen	1,250	480
2	Double pen	680	200
3	Race 34 feet	603	300
4	Race 30 feet	1,004	720
5	Race 60 feet	1,200	400
6	Race 60 feet	1,643	385
7	Race 72 feet	1,650	290
8	Race 72 feet	1,635	300

In considering these quantities, the size of the cattle must be taken into consideration. At tanks Nos. 1, 3 and 4, which are on or adjoining Salisbury commonage, dairy cattle predominate, and the number of small animals—i.e., calves, yearlings and two-year-olds—will therefore be greater than in the average herd of farm cattle. The cattle at No. 2 tank are highly graded throughout, and the average size is considerably larger than in the average herd of farm cattle. At tanks Nos. 5 to 8 inclusive the animals are of the small Mashona type. The double draining pen and the long draining races are very economical; in the latter the wastage is governed largely by the speed at which the cattle are driven through it. The single draining pen can be made as economical as any other plan, but only by a considerable wastage of time.

DIRECTIONS FOR TAKING SAMPLES OF DIP.

The taking of a sample of dip requires care, and should never be left to a native. Thoroughly cleanse a bottle of the "whisky" size. When the contents of the tank have been thoroughly stirred, preferably by the actual dipping of cattle, rinse out the bottle with solution from the tank.

Then fill the bottle completely with solution, cork securely, and stick on the bottle a label stating sender's name, farm, postal address, kind of dip used and the date on which the sample was taken.

When it is expected that the sample will take a week or more to reach the laboratory, it is wise to add about ten spots of sulphuric acid (free from arsenic) to prevent oxidation en route.

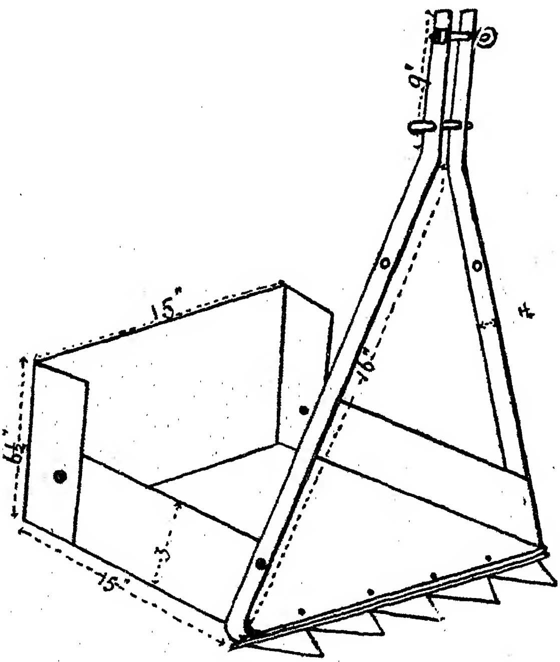
A farmer should not expect the chemist's analysis to save him the trouble of keeping account of the amount of water and dip added to or lost from his tank.

A DIP-TANK DREDGER.

Dipping tanks in use always tend to accumulate a quantity of sediment at the bottom. Though this cannot be avoided, the deposit should be cleaned out as often as possible, because not only is it objectionable to use a filthy dipping fluid, but if the slime or mud is left undisturbed week after week it soon increases sufficiently to reduce appreciably the capacity of the tank. The result is that measurements of the quantity of solution present, based on fixed marks on the tank wall, cease to be accurate, and any estimate of the amount of chemical dip or water to be added will be unreliable, so that it becomes impossible to keep the solution at the right strength. The danger of this state of affairs is obvious, and the only remedy is to clean out the tank regularly.

In order that this may be done without emptying the receptacle, several devices have been tried with varying success. One of the best which is in use in the Salisbury district is shown in the diagram (fig. 3), which gives the approximate dimensions. Little further description is necessary beyond stating that the material of the scoop is thin sheet iron riveted as shown, the front edge is armed with part of an old mower blade riveted in place, the two bent stays are made of flat iron, and the two bolts shown near the top are for holding in position a vertical pole about ten feet long. On the oblique part of the stays will be seen two small holes drilled in the flat iron. These are for the reception of two lengths of strong wire.

The method of use is as follows: The scoop is dropped to the bottom near the middle of the tank, being kept in place by the upright pole held by a man standing on the top of the wall. At the plunge end, two persons hold the ends of the long wires ready to pull. As soon as a strain is put on the wire, the pole-holder may, if necessary, give the scoop a slight forward tilt to cause the mower teeth to



Cattle Tank Dredger

Fig. 3.

enter the mud. When the scoop is full, it is lifted out at the plunge end by means of the two wires and the pole, the latter being now slightly tilted backwards. The process is repeated as often as possible, working always towards the plunge end of the tank, where the greatest mass of deposit will be found. It would be an advantage if the tank were dredged after every dipping day, especially where large numbers of cattle are put through, but this is not absolutely necessary, and in practice it is only used occasionally as the sediment collects.

LOCUST INVASION, 1933.

SOUTHERN RHODESIA.

Monthly Report No. 4, March, 1933.

The hopper outbreak in the Colony has revealed itself more and more clearly during the month under review as of outstanding magnitude. In this respect it far surpasses the heavy outbreak of brown locust hoppers following the invasion of the Colony by flying swarms in 1924.

Not only is a larger area of country involved, but the distribution of the swarms appears to be considerably denser on the whole.

The weather throughout the month has been warm and dry and the hoppers have continued their development apparently unchecked by either disease or parasites, whilst enemies generally have been comparatively inactive.

1. **Nomadacris septemfasciata.**—Hoppers of this species are reported in all stages of development, but the great bulk appear to be in the fifth and sixth hopper stages, whilst a few have already obtained wings.

The winged specimens examined to date exhibit a very different colouration from that of the invading swarms last year. The locusts of the invading swarms were intensely red and exhibited few and inconspicuous minor markings. The base of the hind wings was suffused with purple pink, producing a reddish flash when the insect took to wing. The newly matured adults of the present generation, if they all adhere to the type examined, are more or less medium light brown in appearance with some red on the head, thorax and legs. The light coloured median stripe on the pronotum is very conspicuous and sharply defined and is continued down the olytra. The pink suffusion at the base of the hind wings is lacking altogether.

2. **Locusta migratoria migratorioides.**—A few flying swarms, matured in the low veld and in Portuguese East Africa, have been in evidence during the month and one swarm passed just south of Salisbury flying in a westerly direction.

The destruction of the hoppers of this species on the higher veld seems to have been approximately complete in the North Eastern districts, but the possibility of confusion with the red locust makes the position a little uncertain. The swarms in the low veld were maturing generally at the end of the month.

The newly matured adults of this species examined to date also exhibit a browner and more differentiated colouration than those of the invading swarms last September and November. The median light stripe on the pronotum is also conspicuous and clearly defined and is flanked on either side by a dark brown patch. This stripe was hardly indicated in the invading swarms, which exhibited a nearly uniform brownish red colour, except on the wings.

The prospect in respect to the behaviour of the migratory locust in Southern Rhodesia during the dry season is at present uncertain. From recent observation in Nigeria (Lean) the swarms are judged to favour a relative humidity of between 60, per cent. and 80 per cent. and to tend to follow zones within this range. Away from the eastern border the relative humidity over most of Southern Rhodesia falls below 60 per cent. from June to August, or even later, and it is possible that the range of the flying swarms will be limited by this factor.

3. **Direction of Flight.**—Most newly matured swarms reported to date have shown a tendency to fly in a more or less westerly or south westerly direction.

4. **Feeding.**—The newly matured swarms, once they have taken to flight, are reported to be feeding voraciously.

5. **Parasites and Disease.**—Neither parasites nor disease have been in evidence during the month.

6. **Enemies.**—No unusual activity of locust enemies is reported anywhere, but hawks have been noted following up

flying swarms. Red mites have been noted on newly matured adults.

7. **Destruction of Hoppers.**—The hopper destruction campaign has been continued vigorously in all infested districts and there has been an incessant demand for more and more poison. The quantity of poison issued up to the end of the month was sufficient to make over four and a half million gallons of spray.

Reliance is still placed on the spraying method. Efforts to introduce the dusting method have met with poor success, one of the main difficulties encountered being lack of wind to distribute the dust. There can be no doubt that in unskilled hands the dusting method is considerably more dangerous than spraying both in respect to stock poisoning and in some degree to the operators. The dusting method also seems to be prodigal of poison compared with spraying.

Baiting experiments have in some cases given good results, but the result on the whole has been irregular and the influence of various environmental factors still needs to be elucidated. The indications are at present that baiting is more effective in dry weather than in wet, and it would appear very rash to place much reliance in this method in the light of present indications in view of the fact that locust campaigns in this Colony are generally conducted in more or less wet weather.

8. **Damage to Crops.**—Speaking generally the crops of the farmers have been successfully protected from the hopper throughout the Colony although individuals have suffered serious damage.

Native crops have suffered in certain areas, which are difficult of access, but have been successfully protected in most of the more accessible localities. Many cases of loss of native crops have been due to the reluctance of the natives themselves to go to any trouble to protect their own gardens even when supplied with material. In certain areas, largely in Matabeleland, the drought has made it immaterial whether locust hoppers attacked the crops or not.

RUPERT W. JACK,
Chief Entomologist.

FARMING CALENDAR.

May.

BEE-KEEPING.

Last month under normal conditions should have seen the last honey flow of the season almost ready for robbing, for which purpose have the extractor overhauled, spare crates available, bee escape boards ready, honey jars and bottles ready for usage, and also have a few spare quilts on hand. Do not rob the bees of too much honey, remembering that sending them into winter quarters with a sufficiency of food means a strong issuing colony in the spring. Any new swarms that it may be decided to add to the apiary, feed well if necessary, to induce stimulative breeding while there is time, or if new young queens have replaced older ones also feed liberally this month in the proportion of one part of cane sugar to two of water; for the somewhat wild Rhodesian bee there is nothing like the Alexander feeder let in from the back. Keep all the spaces under hive stands clean, also inspect daily to see that white ants are not building up from the soil; if this is neglected much loss may follow. When seen, sprinkle diluted kerol from a watering can under the hive stand.

Granulation in the bottled honey can be prevented by first ripening the extracted honey in large tins covered with butter muslin for three or four days by exposure to the sun's rays. It should then be heated to a temperature of 150-160 degrees—nothing higher. As soon as this is reached withdraw the tins and bottle when cooling. The best way to obtain this heating is to place the tins in another receptacle of cold water and boil it up to the required heat, as heating it direct over a fire is very liable to burn the contents or to impair the delicate flavour of the natural honey.

CITRUS FRUITS.

The harvesting of the early ripening fruit should be commenced about the first week in May. Exporters should cure their Washington Navels for a longer period than usual; this will enable them to detect the thick skinned fruit easily. Where necessary, irrigation should be continued up to within ten days of harvesting. All ploughing and cultivation should be completed without delay.

CROPS.

Continue to cut and stook maize as it matures; make the stooks small to assist drying. Later in the season the stooks may be made larger. See that the stooks are secure and pick up plants lying on the ground. Continue to plough up land between stooks of maize. Give all maize harvested, whether husked or in the husk, a chance to dry out before riding to the dumps. Do not begin shelling if the ears are still damp. Do not use new grain bags for harvesting maize. Make the dumps of unhusked ears as small as possible; the smaller the dump the quicker the grain will dry out. Grain on the cobs dries extremely slowly, if at all, in dumps of large size. Do not mix unhusked ears from the stooks with dryer ears harvested later from the standing crop. Keep the dryer ears in a separate dump; shell, bag and stack such maize separately. When cutting maize for stooking, insist on the stalks being cut within 2 to 4 inches of ground level. The plough, in Rhodesia, will not bury roots with stalks 8 to 12 inches high. A long stubble of stalks makes clearing of the ground for ploughing very tedious and expensive. If not already harvested, ground nuts should be

lifted before the first frosts damage the hay. Finish transplanting onions from seed-beds. If plants are not flourishing after transplanting, give a light dressing of nitrate of soda—50 lbs. per acre. Repeat in a fortnight if needed. Sow most winter cereals on wet vleis or under irrigation early this month. Feed your sweet potato vines to stock; if frosts occur the vines will be killed. Dig and feed tubers from end of month onwards. Towards end of month harvest cattle pumpkins and melons and handle carefully; avoid bruising to prevent rotting. Place pumpkins and melons in a dry situation in the open and in a single layer. Supply plenty of roughage to cattle pens, kraals and stables to increase the manure supply. Collect and cart manure to lands for spreading. Do not attempt to plough in dry grass or quantities of maize refuse. The plough will not turn it under and it will not rot before next planting season. Burn such refuse and make a good job of the ploughing. If the weather seems set fair, commence brick-making. A small kiln of bricks always on hand is most useful. As labour permits, re-thatch buildings and outhouses in need of repair. Overhaul, grease and paint planters, drills and other implements not required again until next season, and store away under cover. Think about your fertiliser requirements for next season and place your orders. From now onwards the second ploughing of new land broken up earlier in the season should be pushed on with as opportunity offers.

DECIDUOUS FRUITS.

The pruning of early ripening peaches should be performed this month. All holes should be completed and kept in readiness for June planting. Ploughing or digging and cultivation should be completed without delay.

ENTOMOLOGICAL.

Cabbage Family.—Plants of this family are liable to suffer greatly from cabbage louse (aphis) and Bagrada bug during May. For the former wash the plants frequently with a strong stream of cold water from a spray pump, or spray with soap and tobacco wash. Transplants may be dipped in the latter. Plants attacked by Bagrada bug may be sprayed with resin wash when the young bugs are exposed in the early morning.

Citrus Trees.—Continue to collect and destroy all fruits infested with citrus codling. Fumigate or spray for scale insects if necessary.

Guava.—Fruit fly and citrus codling breed in these fruits during the autumn and winter. Collect fruit and destroy.

Tobacco.—Watch should be kept for the emergence of the adult wire-worm beetles. These should be poisoned with a bait consisting of maize bran moistened with a solution of 1 lb. arsenite of soda in 20 to 30 gallons of water. The bait should be rolled into small balls and scattered on the lands, one ball to each ten square yards. The bait should be covered with a few leaves and moistened as required. Chopped green stuff such as Napier fodder may also be used as a carrier for the poison, in which case molasses should be added at the rate of 1½ gallons to 10 gallons of the arsenite solution, or cheapest sugar at the rate of 10 lbs. per 10 gallons. The bait is best laid in the evening.

Fields of tobacco found to be heavily infested with gallworm should be thoroughly ploughed and cross-ploughed and laid down to an immune crop next season.

Cotton.—Continue trapping and destroying stainers. All dropped bolls should be collected and destroyed.

Maize.—Clean up storage sites, sidings and sheds against weevil.

Potatoes.—Late potatoes should be kept earthed up to prevent tuber moth from attacking the tubers.

FLOWER GARDEN.

The month of May is a suitable one for the preparation of new flower beds. The ground should be well trenched, and if of poor quality, a light

dressing of well rotted manure will be a distinct advantage. Too heavy dressing is not advised, as too rich a soil is likely to produce an abundance of foliage and very few flowers. It is not too late to sow sweet pea seeds, but the best results come from early planting. By this time all bulbs for spring flowering will be planted. Chrysanthemums, delphiniums, dahlias and other herbaceous perennials may now be cut down, and if necessary taken up, divided and replanted

VEGETABLE GARDEN.

It will be necessary during the early part of the month to clear off what remains of summer crops, such as haricot beans, peas, cucumbers, etc. Where winter deep rooting vegetables are to be grown, such as carrots, parsnips and beets, the soil and sub-soil should be deeply worked, so as to allow a ready root run for these vegetables. A dressing of lime will be of great value in every section of the kitchen garden. This will especially help to minimise future attacks of insects and fungus attacks. New asparagus beds may be made this month; old beds should be cut down, cleaned and kept in good order; also a light dressing of stable manure may be given to the beds. Planting may be made of all seedlings, such as cabbage, cauliflower, lettuce, onions, etc., and seeds of carrot, leek, lettuce, onions, peas, radish, turnip, parsnip, broad beans may be sown.

FORESTRY.

Continue pricking out coniferous seedlings into tins or beds. Deciduous trees which are propagated by means of cuttings should be taken in hand. See that the fire lines are in order, and in the case of woods which have formed canopy, remove inflammable material below the edge trees.

POULTRY.

All cockerel chickens should be separated from the pullets, and every month gone over carefully, the poorer ones eliminated and only the very best kept. Those cockerels with the deep long bodies, short legs and round heads should be kept. Those with any inclination to long legs, knock knees, long heads or thin beak, lop-over combs, narrow bodies, or those lacking length and depth should be rigorously discarded. The chickens must not be allowed to become chilled, especially at night; on the other hand, they must not sleep in a hot stuffy atmosphere. On no account must they be overcrowded; this is fatal and is one of the many rocks on which poultry keepers come to grief.

The young stock must have all they can eat; to stint them is to ruin them for good and all. A bird that has been stunted never recovers. A good quality bone meal (lime phosphate) is absolutely necessary, as is also plenty of succulent green food, and no animal protein is better than thick separated milk for the health and growth of the chickens.

Those going in for ducks should hatch according to the numbers they have to supply for eating each week. Ducks must have all the food they will eat from the time they are hatched. A quick-growing duck should put on 1 lb. per week and be ready for killing at from seven to eight weeks old. Always kill or sell for killing just before the large wing feathers commence to grow.

If the rains have stopped, turkeys can be hatched. See that the youngsters are kept warm, but also that they have plenty of fresh air. Never feed young turkeys on wet or moist food, but give dry mash, grain, plenty of onion tops or onions chopped small, and thick separated milk. Keep them free from insect vermin; they will never thrive if they are infested with these.

Never allow the hen that has hatched the turkey eggs to run with the youngsters. Always confine her in a coop, through the slats of which the young turkeys can run in and out. The coop should be moved to fresh ground each day; nothing is worse for young turkeys than to be running on the same piece of ground for long at a time. Tainted ground is one of the chief causes of mortality among young turkeys.

STOCK.

Cattle.—By the middle of this month dairy cattle will require more serious attention in the matter of feed. Grass should be cut for bedding, and both cows and calves should be well bedded down at night from now onwards, and cowsheds should be put in good repair. Attention should be given to the water supplies, and care taken that they are clean and sufficient.

Boggy sources of water supply are a frequent source of loss of cattle during the winter months. With adequate water supplies cattle can withstand considerable shortage of grazing. Weaners should be fed a good roughage ration—with or without a small allowance of grain, depending on circumstances—to keep them growing through the winter months.

Get in the bullocks for winter fattening.

Sheep.—The ewes should be lambing now. It is the general experience in the Colony that winter lambs are better than spring ones. Adequate feed must be provided to keep up the milk flow of the ewes. For this purpose a stand of winter oats or barley, on which the ewes can graze for an hour a day, is excellent. A little maize with a legume hay will also give very good results. Where roots do well, they will make a valuable succulent feed for sheep. The sheep should have access to some shelter from the cold winds. Dock the lambs.

TOBACCO.

Curing should be completed as early in the month as possible to prevent loss from frost. The bales of tobacco should be examined and turned weekly until they are despatched from the farm. All bulks must be inspected regularly and turned if necessary. Tobacco seed should be shelled as soon as the seed pods are dry and the seed carefully labelled and stored in a dry place. The stumping, clearing and ploughing of new land, if operations have not already been commenced, should be no longer delayed. Land which has just produced a crop should be ploughed and harrowed as soon after the harvest as possible.

VETERINARY.

Horse-sickness will still be in evidence, and may be expected to continue until the frosts occur. Inoculation for blue tongue should be performed in the dry season only, unless the animals can be kept under cover for 21 days. Do not inoculate ewes in lamb on account of abortion. Inoculated animals spread the disease for 21 days. Scab is a poverty winter disease.

WEATHER.

During the major portion of this month the ordinary winter conditions prevail, viz., cloudless sunny days and cold nights. Frost may be normally expected at any time during the latter half of the month. There is often, however, a recrudescence of rain conditions during the early portion of the month, resulting in overcast days and light drizzling showers, the normal rainfall at many places, particularly in the southern and eastern portions of the country, amounting to over half an inch.

June.

BEE-KEEPING.

At this season hives require to be painted; the woodwork, being exceedingly dry, is in good condition to receive it. Linseed oil (unboiled) is the best kind to mix with white lead, as it is more penetrating, acting

as a better preservative than boiled oil. Bees will be able to take beneficial flights during warm days, so that dysentery need not be anticipated.

CITRUS FRUITS.

Cultivation of the grove is to be continued. Early ripening fruit must be harvested and marketed without delay. Mid-season varieties will be fit for packing early in the month. These should be shipped as early as possible, so as to extend the late variety export season as much as possible. Most late ripening varieties will require irrigating during the month.

A small amount of pruning should be done. If fumigation is to take place, remove the small branches that touch the ground, cut out all dead wood and water shoots.

CROPS.

Select seed from the very best of your own crops. It is always wise to keep more seed than you may need for planting. Do not shell and ride your maize to the railway unless it is fit for export or market. If in doubt regarding the moisture content of the maize, send a 2 lb. sample in an air-tight tin, such as a golden syrup tin, to the Agricultural Department and have it tested. Provide ample dunnage for your maize stacked at the railway or on the farm. Use maize cobs; husks are almost useless for this purpose. Sew your bags of maize according to the export regulations and stack them properly at the railway side, leaving plenty of room between the double rows. Select pumpkin and melon seed from the best specimens. Support your agricultural show and make it a success by preparing and entering as many exhibits as you can. No one is more to blame for a poor show than the farmers themselves. Make a list of the seed requirements for next season, and where purchases must be made, place the orders early.

In cleaning up the cotton fields care will have to be exercised in the supervision of the pickers. The cotton harvested at this period of the season generally comes from late bolls naturally matured and those prematurely opened by the cold weather and frost. The matured seed cotton should be kept entirely separate from the immature seed cotton. There will also be some dirty and stained cotton in this final picking. Arrangements for next season's seed requirements should receive consideration.

Veld fires must be anticipated, and if not already attended to, the mowing or burning of fire-guards, both boundary and internal, should be proceeded with.

DECIDUOUS FRUITS.

General pruning may be done this month if the leaves have fallen. This should be confined, as far as possible, to the thinning out of diseased, weak, broken and dead shoots. Tall trees may be reduced in height, and old and unprofitable trees headed back to induce the growth of new fruiting wood. Trees that shed their leaves late may be pruned in July. The necessary preparations for planting trees should be completed during the month and planting commenced towards the end of the month. Cultivation should be continued.

ENTOMOLOGICAL.

Cabbage Family.—Plants of this family suffer from cabbage louse and Bagrada bug during June.

Onions.—Suffer from thrip. The transplants may be dipped as far as the roots in tobacco wash or paraffin emulsion to keep down the pest.

Fig.—The winter crop of fruit is liable to suffer from fig weevil. The infested fruit should be collected and destroyed. If this has been done regularly with the first crop, the second crop is not likely to suffer much.

FLOWER GARDEN.

Annuals for early spring flowering should be sown, preferably in paraffin tins cut lengthwise, in a place sheltered from the wind. Perennials, shrubs and ornamental tree seeds may also be sown. Fruit trees, shrubs and roses should be pruned and all dead wood removed. Sweet peas require constant attention.

VEGETABLE GARDEN.

All the available space in the garden should now be thoroughly trenched and manured, the soil being well worked and loosened. Vegetables planted out for winter crops should be well and continuously cultivated, which will help to bring them along quicker and with less watering. Late-bearing tomatoes should be sheltered from the cold winds by a grass shield. Beet, radish, carrot, parsnip, turnip, onion, leek, mustard, cress and tomatoes may be planted.

FORESTRY.

Care should be taken by further ploughing of land or burning of grass that all fireguards round plantations are in good order and effective. Thinnings where necessary may be continued, and fellings which are to be made are to be carried out. Cuttings may be taken and struck now of deciduous trees, such as the Carolina poplar. The pricking out of conifer seedlings into tins should be continued, and sowing of such seed for the coming planting season may be completed. A commencement may be made of preparation of land to be planted during the ensuing season, e.g., by stumping if necessary, and ploughing where practicable.

GENERAL.

Grazing is deteriorating, and the next few months may be a period of difficulty for the rancher. It is a mistake, frequently seen, for all the grazing nearest to the drinking places to be first consumed, so that later on the cattle, when least able to endure fatigue and when the grass is in any case most scanty and dry, have furthest to walk from the feeding ground to water. A little forethought can obviate this trouble. Live stock are usually in good condition at this time of year and able to travel longer distances to water than may be the case later on in the season. Fire guards to prevent grass fires should be looked to.

POULTRY.

The poultry keeper must be on the look-out for sudden cold snaps, for if some precautions are not taken, the production of eggs will drop.

This is one of the poultry keeper's busiest periods, but method, cleanliness and attention to details pay him well. Do not leave anything that you can spare the time to do yourself to natives. Watch carefully your breeding birds, and on the slightest sign of one going off, take him or her away; if left, you will have infertile eggs, weak germs, weak chicks difficult to rear, and later weak and unprofitable stock. See that the male bird has all the food he requires, and give him a meal by himself twice a week, also a small piece of raw meat three times a week. Those who are using incubators should watch the temperature of the room on cold nights, for variations in temperature result in delayed and poor hatches, and often deformed chicks.

STOCK.

Cattle.—Cows with autumn calves should be kept in the more sheltered paddocks. A watchful eye should be kept on all watering places in order to prevent their being fouled or stopped up. Where winter calves are required, the bulls should be kept out of the herd until the end of July at least, and, in the meantime, they should be well fed and cared for in order to fit them for their work. The three watchwords in the dairy herd should be feed, shelter and bedding from now onwards. Ensilage will now be found invaluable, as also will pumpkins, majordas or any other form of

succulent food. Good hay should be used to rack up with at night, and the maize ration should be supplemented with ground nuts, ground nut cake or bean meal. Young calves are better in the pen on very cold mornings until the sun has gained some power, when they may run on short, sweet veld for a few hours.

Sheep.—Continue to feed the ewes and lambs well. Older sheep should generally also be given some supplementary feed now. Sheep should not be allowed to get into low condition, especially in areas where parasite infection is to be feared.

DAIRYING.

At this time of the year the farmer should experience very little difficulty in producing cream of first-grade quality. During the winter months the separator should be adjusted so as to deliver cream testing 40 to 45 per cent. butter fat.

On exceptionally cold days care should be taken that the milk is not allowed to become too cold before separation—for efficient skimming, the milk should be separated immediately after milking and at a temperature not lower than 90 degrees F.

Farmers engaged in butter-making are usually successful in obtaining a good grain and firm body in butter at this season of the year. During cold weather it is frequently necessary to warm the cream for churning. The most satisfactory method of warming the cream to the proper churning temperature is to place the bucket or receptacle containing the cream in a tub or bath of water at a temperature of about 95 degrees F., stir the cream frequently and replace the water when cold.

Under the cool conditions which obtain from this time of the year onwards, cheese-making operations are usually most successful.

Care should always be exercised, however, in using evening's milk. If the milk is over-acid it should not be used, or a hard, dry cheese will result. Morning's milk plus a starter usually gives the best quality of cheese. The starter should have a clean sour taste and smell. In early winter, milk for cheese-making frequently contains a high percentage of fat, and in order to firm the curd properly in the whey it is usually necessary to raise the scalding temperature a few degrees.

At this period of the year winter feeding of dairy stock should commence in real earnest. The milking cows should now be in fairly good condition, and in order to maintain a full flow of milk throughout the cold, dry months of winter, it is essential that liberal feeding be practised. As far as possible an attempt should be made to imitate summer conditions by feeding an abundance of succulent and palatable food. Maize silage, sweet potatoes, pumpkins, etc., are very useful for this purpose, but these feeds should be supplemented by dry roughage of good quality, preferably a legume hay, and a liberal allowance of mixed concentrates.

For dairy heifers, weaned calves, etc., there is possibly no better ration than one consisting of maize silage, legume hay and mixed concentrates, and these feeds, if supplied in liberal quantities, should serve to keep the young stock in a thrifty, growing condition.

TOBACCO.

The grading of tobacco should be proceeded with. Any bales stored on the farm should be turned occasionally, especially where more than one bale is placed on another. Arrangements for the grading of tobacco seed should be made for the coming season. Growers purchasing tobacco seed should place orders early with distributors of reliable seed.

VETERINARY.

Horse-sickness should be practically over now. Redwater and gall-sickness occur all the year round, but the worst time is the summer, when ticks are prevalent. Blue tongue should be very little in evidence now. Inoculation can be carried out now. Scab is a poverty winter disease.

WEATHER.

Casual rains may occur, but except on the eastern frontier, none is to be reckoned upon, nor can it be regarded as seasonable or desirable. Frosts generally occur on a few nights during the month of June, and precautions must therefore be taken. This month and the next are the coldest of the year, and when the cold is accompanied by dull weather or "Scotch mist," known locally as "guti," it is apt to have a severe effect on live stock, especially if grazing should at the same time be scarce and water supplies far to travel to.

SALES.

AGRICULTURAL EXPERIMENT STATION, SALISBURY.

Spineless Cactus Slabs (blades) Algerian variety, per 100 slabs, 7/6 Salisbury, or 12/6 delivered free by rail to purchaser's nearest station or siding in Southern Rhodesia. For amounts of 500 slabs or more a reduction of 2/6 per 100 will be made.

Stocks are limited and delivery cannot be undertaken after 15th November.

Kudzu Vine Crowns, per 100 crowns, 15/-, Salisbury, or 25 crowns, 7/6; 50 crowns, 15/- and 100 crowns, 22/6, delivered free to purchaser's nearest station or siding in Southern Rhodesia. Delivery during September and October for irrigated land, and in January for dry land. Owing to pressure of other operations, it is not possible to deliver Kudzu crowns during November and December.

Woolley Finger Grass: 10s. per bag of roots, delivered on rail nearest station or siding; supplies limited. Available January and February.

The prices quoted above do not include charges for road motor transport. Cheques should be made payable to the Department of Agriculture, and preliminary enquiries and subsequent orders should be addressed to the Chief, Division of Plant Industry, Department of Agriculture, Salisbury.

SOUTHERN RHODESIA VETERINARY REPORT.

February, 1933.

AFRICAN COAST FEVER.

Fresh outbreaks occurred on the farms Lindley and Vooruitzicht in the Melsetter district. Both these farms adjoin the farm Rocklands, which was heavily infected during 1932. The total number of cattle involved is 313, and the mortality to end of the month was 7 head.

SWEATING SICKNESS OF CALVES.

Very prevalent in the majority of districts.

TUBERCULOSIS.

Post-mortem examination on a Friesland heifer in the Selukwe district showed tuberculosis. The in-contact animals were subjected to the tuberculin test. One cow reacted and was destroyed; *post-mortem* examination showed tuberculosis. One bull gave a doubtful reaction and will be re-tested at a later date.

TRYPANOSOMIASIS.

Seven cases in cattle were diagnosed in the high veld in Melsetter district.

IMPORTATIONS.

Nil.

EXPORTATIONS.

Frozen beef (boned) to United Kingdom: 40,575 lbs.

J. M. SINCLAIR,
Chief Veterinary Surgeon.

SOUTHERN RHODESIA WEATHER BUREAU.

MARCH, 1933.

Pressure.—The barometric pressure was generally high during the month varying from 1.6 mb. above normal at Bulawayo to 0.3 mb. above normal at Umtali.

There were six highs during the month, the third, which appeared on the S.W. coast on the 8th, moved very fast behind a trough of low pressure and traversed Southern Rhodesia accompanied by a marked line squall. The fifth appeared on the East coast. The remainder followed the normal course.

There were seven lows, the majority of which appeared on the W. coast and traversed the usual path.

The second became central in the Union on the 8th and was very deep and traversed Southern Rhodesia very rapidly followed by the line squall mentioned above.

The bulk of the rain fell at the passage of this trough.

Temperature.—The mean maximum temperatures were above normal and the mean minimum below normal. Very high maximum temperatures were recorded in S.W. Matabeleland where excesses of 6 degrees above normal were recorded.

Rainfall.—The rainfall from telegraphic reports amounted to 0.4 of an inch compared with the average 4.21 inches. March rainfall has only once before been below an inch in 1914 when 0.84 was recorded. The following stations recorded no rainfall for February and March: Empandeni, Ferndale, Insindi, Lancaster, Mangwe, Wanizi and Wenlock Store. These stations all lie in the S.W. area.

Seasonal Total and Forecast.—A forecast indicating a below normal season was issued officially early in December. The actual rainfall for the period October to March is 22.4 inches, as compared with the normal 26.8 inches.

MARCH, 1933.

Station.	Pressure Millibars, 8.30 a.m.		Temperature in Stevenson Screen °F.								Rel. Hum.	Dew Point	Cloud Amt.	Precipitation.			Altitude (Feet).
			Absolute.		Mean.												
	Mean.	Normal.	Max.	Min.	Max.	Min.	½ Max. Min.	Normal.	Dry Bulb.	Wet Bulb.	%	F.	0-10	Ins.	Normal.	No. of Days.	
Bulawayo ...	869.8	868.2	90	51	85 6	57.3	71.4	69.0	70.5	60 3	54	53	1.7	.05	3.3	1	4,436
Gwelo	863.0	...	87	49	83 3	56.5	69.9	69.6	68.9	61.4	66	57	2 2	.83	3.3	2	4,632
Riverbank ...	...	...	97	54	91.2	59.3	75.2	71.7	72.3	62.8	59	57	...	.25	4.1	3	4,100
Essexvale ...	...	...	99?	52	91.2?	58.8	75.0?	71.1	67.0	61.5	73	58	...	.10	3.8	1	3,828
Gwanda ...	906.3	...	92	53	87.0	59.6	73.3	...	72.9	64.0	62	59	1.4	.41	2.0	1	3,235
Mazunga ...	948.8	947.7	97	56	89.3	61.7	75.5	76.4	75.5	65.6	59	60	2.3	1.58	2.2	1	1,970
Nuanetsi ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1,630
Between Rivers	...	...	91	50	86.7	57.3	72.0	...	70.0	64.2	73	61	3.7	1.24	6.2	5	3,970
Enkeldoorn ...	858.2	...	85	51	80.9	56.0	68.4	68.7	67.6	61.4	70	57	2.6	.72	3.8	3	4,720
Gatooma ...	...	...	92	51	88.3	56.6	72.5	72.7	69 3	63.9	74	61	1.8	.32	4 2	2	3,850
Miami	879.0	...	85	55	81.1	60.4	70.7	...	69.0	63.9	75	61	5.0	.11	5.5	2	4,090
Salisbury ...	855.4	854.8	85	50	81.0	57.0	69.0	68.6	68.0	61.3	69	58	3.8	.34	6.0	4	4,890
Sinoia ...	888.1	...	90	51	86.3	58.7	72.5	...	71.4	64.7	70	61	3.0	1.08	4.0	4	3,804
Sipolilo... ...	...	...	84	55	80.3	59 6	69.9	...	70.4	64.3	72	61	2 4	1.20	4.1	6	3,900
Inyanga ...	...	...	81	48	76.4	53.0	64.7	...	67.7	58.6	57	52	2.4	.07	5.9	1	5,530
Mtoko ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	4,210
Bindura ...	...	...	86	54	82.3	61.3	71.8	...	70.0	64.6	74	61	5.0	.41	5.5	2	...
Angus Ranch ...	...	...	93	58	87.3	63 8	75.5	75.1	73.8	66.9	70	64	...	.13	5.0	2	2,300
Craigendoran ...	...	...	96	55	88.0?	59.7	73.8?	...	75.4	67.7	67	63	...	.44	6.2	1	3,410
New Year's Gift	...	...	92	51	85.1	60.3	72.7	...	71.5	65.7	74	63	...	.80	4.3	2	2,700
Rusapi ...	...	...	85	49	82.1	55.4	68.7	...	68.7	62.1	69	58	2.1	.11	6.2	2	4,640
Riverdene North	...	...	93	48	87.4	54.4	70.9	...	68.9	63.1	73	60	...	...	5.0	..	3,700
Stapleford ...	...	...	75	43	70.1	52.0	61.0	...	62.3	59.8	86	58	5.2	2.16	5.3	6	5,450
Umtali	893.3	893 0	90	56	81.5	60.4	71.0	70.6	70.2	64.5	74	62	4.0	.43	5.3	3	3,677
Victoria ...	896.2	895.4	90	52	84.5	57.9	71.2	69.0	70.8	63.0	65	58	1.9	.03	3 7	1	3,570
Melsetter ...	850.8	...	80	50	75.9	54.0	64.0	...	67.0	60.3	68	56	2.3	.53	7.7	3	5,060
Mount Selinda	...	...	83	55	77.4	59.6	68.5	...	67.4	63.6	81	61	3.4	.62	11.7	5	3,520
Manchester ...	...	...	79	50	72.9	55.4	64.2	...	58.3	56.6	91	55	...	1.46	...	9	...

Rainfall, March, 1933, in Hundredths of an Inch. Telegraphic Reports.

rea	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Total.
1	...	...	...	...	...	...	3	44	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	..	...	...	...	...	...	47
2	...	...	...	...	...	...	...	31	...	...	...	...	...	..	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	31
3	...	...	...	...	...	...	...	86	...	...	1	13	...	...	...	...	1	...	...	...	...	...	...	...	...	11	...	...	...	...	...	112
4	...	...	...	...	...	...	21	41	1	...	...	..	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	63
5	...	...	...	1	...	...	12	5	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	18
6	...	...	...	...	...	...	..	17	3	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	20
7	...	...	...	...	1	...	...	22	1	...	...	...	...	2	1	...	...	...	3	...	...	...	...	...	...	2	...	...	...	...	...	32
8	7	...	...	...	...	...	1	6	3	...	...	...	...	1	3	...	...	...	7	...	...	...	...	...	...	...	...	..	...	...	...	28
9	11	2	...	6	8	8	4	...	1	5	...	6	...	6	4	...	...	...	19	2	...	...	...	...	...	...	...	...	...	...	...	82
10	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	3	...	...	...	...	...	4
ean	12	...	...	1	1	1	5	22	1	1	...	1	...	1	1	...	...	...	3	...	...	...	...	...	...	1	...	...	...	...	...	41

DEPARTMENTAL BULLETINS.

The following Bulletins, consisting of reprints of articles which have appeared in this Journal, are available for distribution at 3d. per copy. Application should be made to the Editor, Department of Agriculture, Salisbury, and remittances must accompany orders.

AGRICULTURE AND CROPS.

No. 225. Napier Fodder or Elephant Grass, by J. A. T. Walters, B.A.

No. 374. Fibre Crops—Deccan Hemp (Hibiscus Cannabinus) and Sunn Hemp (Crotolaria Juncea), by J. A. T. Walters, B.A.

No. 429. Propagation of Kudzu Vine, by H. C. Arnold.

No. 510. Check-row Planting of Maize, by H. G. Mundy, F.L.S.

No. 545. Artificial or Synthetic Farmyard Manure, by H. G. Mundy, Dip.Agric., F.L.S.

No. 550. Onion Growing under Irrigation, by C. Mainwaring.

No. 561. Wheat Growing in Rhodesia, by C. Mainwaring.

No. 568. The Treatment of Arable Land, by G. N. Blackshaw, O.B.E, B.Sc., F.I.C.

No. 598. Drought-resistant and Early-maturing Crops for Areas of Late Rainfall, by C. Mainwaring.

No. 630. The Storage of Seed Potatoes, by H. C. Arnold.

No. 634. Barley, by P. V. Samuels.

No. 643. Noxious Weeds in Southern Rhodesia, by F. Eyles, Botanist.

No. 650. Coffee Culture in Southern Rhodesia, by G. W. Marshall, Horticulturist.

No. 651. Two Important Leguminous Crops: The Velvet Bean and Dolichos Bean, by C. Mainwaring, Agriculturist.

No. 663. The Use of Fertilisers and Manures in Southern Rhodesia, by A. D. Husband, A.I.C., Chief Chemist.

No. 672. Hay-making in Rhodesia, by H. G. Mundy, Dip.Agric., F.L.S.

No. 674. Top Dressing of Maize against Stalk Borer, by H. C. Arnold.

No. 681. The Sunflower (Helianthus Annuus) (Revised), by S. D. Timson, M.C., Dip.Agric.

No. 694. The Edible Canna (Canna Edulis), by D. E. McLoughlin.

No. 695. The Castor Oil Plant (Ricinus spp.), by S. D. Timson, M.C., Dip.Agric.

No. 697. Results of Analysis of Samples taken under the "Fertilisers, Farm Foods, Seeds and Pest Remedies Ordinance" during the year 1927-28.

No. 704. The Importance of Research on Pasture Improvement in Southern Rhodesia, by A. D. Husband, A.I.C., Chief Chemist.

No. 705. Suggested Cropping Programmes for Farms on the Sand Veld, by D. E. McLoughlin, Assistant Agriculturist.

No. 706. A Farmers' Calendar of Crop Sowings, by C. Mainwaring, Agriculturist.

No. 709. Sand Veld Farming and its Possibilities, by E. D. Alvord, M.Sc. (Agr.).

No. 710. Monthly Reminders for the Farming Year, by the Division of the Chief Agriculturist.

No. 727. Farmyard Manure, by A. P. Taylor, M.A., B.Sc., Agricultural Chemist.

No. 732. Two Common Diseases of Potato Tubers in Rhodesia, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A.

No. 743. Sunn Hemp, by S. D. Timson, M.C., Dip.Agric.

No. 751. The Sweet Potato, by S. D. Timson, M.C., Dip.Agric. (Wye).

No. 757. Maize on the Sand Veld: Results at the Tobacco Experiment Station, Salisbury, by C. A. Kelsey-Harvey, Manager.

No. 758. Instructions for Taking Soil Samples. Issued by the Division of Chemistry.

No. 759. Witch Weed (Striga Lutea): Methods of Control, by S. D. Timson, M.C., Dip.Agric. (Wye).

No. 762. The Value of Rock Phosphate and "Bone and Superphosphate" as Fertilisers for Maize Production, by A. D. Husband, Chief Chemist.

No. 768. The Ground Nut (Arachis hypogaea), by S. D. Timson, M.C., Dip.Agric. (Wye).

No. 776. Regulations Governing the Export of Maize and Maize Meal through the Port of Beira.

No. 797. Green Manuring: An Essential Practice in Rhodesian Farming, by H. G. Mundy, Dip.Agric. (Wye), F.L.S., Chief Agriculturist.

No. 802. Witch Weed, by S. D. Timson, M.C., Inter.B.Sc. (Agric.) Lond., Dip.Agric. (Wye), Assistant Agriculturist.

No. 807. Studies on the Improvement of Natural Veld Pastures: No. 2, by A. D. Husband, F.I.C., and A. P. Taylor, M.A., B.Sc., Chemistry Branch, Department of Agriculture.

No. 813. A Preliminary Note on Clovers in Southern Rhodesia, by S. D. Timson, M.C., Dip.Agric. (Wye), Assistant Agriculturist.

No. 815. New Strains of Oats for Southern Rhodesia, by H. C. Arnold, Manager, Agricultural Experiment Station, Salisbury.

No. 816. Preliminary List of the more Common Grasses of Southern Rhodesia, by Sydney M. Stent, Botanist for Pasture Research.

No. 820. The Great Economic Problem in Agriculture—No. 1, by J. R. McLoughlin, M.Sc. (Economics), Economic Adviser.

No. 822. Re-stacking of Maize rejected for Export on account of Excessive Moisture.

No. 823. The Law of Supply and Demand—No. 2, by J. R. McLoughlin, M.Sc. (Economics), Economic Adviser.

No. 826. Some Poisonous Plants of Southern Rhodesia, by Sydney M. Stent, Senior Botanist.

No. 831. Revised Notes on Cotton Growing in Southern Rhodesia, by G. S. Cameron.

No. 833. Subterreanean Clover on the Sand Veld as Feed for Poultry in the Winter, by S. D. Timson, M.C., Dip.Agric. (Wye).

No. 836. The Potato, by S. D. Timson, M.C., Dip.Agric. (Wye).

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EDITORIAL.

Contributions and correspondence regarding subjects affecting the farming industry of Southern Rhodesia are invited. All communications regarding these matters and advertisements should be addressed to:—The Editor, Department of Agriculture, Salisbury.

The Tobacco Season.—The current season has been one of difficulties for tobacco growers in general. In many instances the seedbeds were unsatisfactory owing to the activities of insect pests, and damage in other cases resulted from heavy rain-storms and hail. The planting rains were exceptionally late in many areas, and many seedbeds had to be discarded owing to the seedlings becoming overgrown. Cutworm and wireworm were active, and in quite a number of cases fields were transplanted five times. Following this was the damage caused by the heavy and incessant rainfall during the months of December and January. The earlier planted tobacco failed to make satisfactory growth, and the leaf remained small and narrow. The middle plantings produced a normal growth owing to the improvement of climatic conditions. The later planted tobacco has suffered for want of rain, and consequently the leaf is of inferior quality and is undersized. The diseases known as "Red Rust" and "Barn Spot" have been prevalent and caused a considerable degree

of damage. The variety of tobacco "White Stem Orinoco" constituted the bulk of the crop. Other varieties used were "Willow Leaf," "Hester," "Goldleaf," "Cash" and "Blackwell's Improved Hickory Pryor." The last-named variety is considered suitable for market requirements, and is therefore not to be confused with the old type of "Local Hickory Pryor," which it has replaced.

Export of Chilled Beef.—Weekly shipments of chilled beef have been continued since 7th April.

The reports from overseas state that the condition and dressing of the meat is being improved shipment by shipment. Prices, however, have so far not been very satisfactory. It is reported that large shipments of Brazilian beef of similar quality have depressed the market and made an early clearance of the beef difficult. The distributors say, however, that the beef is of useful quality, and that we may expect a good demand for it from retailers if regular supplies are available.

The chief criticism overseas has been that the beef has been insufficiently covered with fat, especially on the forequarters, and that some of it is too aged. The rejections at Bulawayo have on the whole tended to decrease as the exporters have become more familiar with the requirements of the trade, but a considerable number of bullocks which are too old or coarse are still forwarded.

Bruising is still causing a good deal of damage, and much meat has to be forwarded with surface bruises which, though they do not spoil the beef, certainly depreciate its appearance and selling price.

It is the intention to publish a full report on the results of these early shipments in the near future.

Tobacco Pest Suppression Act, 1933.—All tobacco growers are urged to make themselves familiar with the contents of this Act, which was promulgated on 19th May, 1933. It should be noted that the term "tobacco pests"

under this Act applies to the pests of both growing plants and cured leaf. Provision is therefore made for the inspection and licensing of premises where tobacco is stored and handled, and for the removal and destruction of the old plants after the crop has been picked. The tobacco industry is of such importance to the Colony that the restrictions imposed by this Act are not only necessary to safeguard its development and expansion, but were actually sought by the majority of growers and buyers of the crop.

Conference to Consider Cattle Cleansing Act.—About the middle of last month Mr. J. L. Martin, M.L.A., moved that a conference, representative of the Rhodesia Agricultural Union, the Matabeleland Agricultural Union, the Eastern Districts Federation, the Midlands Agricultural Union and the Rhodesia Stock Owners' Association, be called by the Government to enquire into and to report upon the working of the "Cattle Cleansing Act, 1927."

Mr. Martin said that when the Cattle Cleansing Act was promulgated it was a good one, but since then new knowledge and new experience had been gained, and the time had come to review the Act with a view of making it more effective.

From the discussion which took place it was obvious that a revision of the position is desirable, and the Honourable the Minister of Mines and Agriculture accepted the motion on behalf of the Government.

Particulars regarding the constitution of the conference and the date of sitting will be given later.

The World's Wool Position.—The first of a series of "Wool Intelligence Notes," issued on behalf of the Wool Statistics Advisory Committee of the Empire Marketing Board, has just been received. It reviews the world wool situation at the end of March and summarises the latest available statistics with regard to wool production, stocks, exports, imports and prices.

Any reader who is interested in the details given may obtain a copy on loan from the Editor.

The world's wool production is being maintained at a volume not far below the record level of the years 1928 and 1929, despite five years of low prices. Southern Hemisphere countries, as a whole, have not yet reduced their output, although smaller sheep figures are reported for New Zealand and Uruguay. At the same time, the United States and Russian production has fallen recently, particularly the latter, where the decline may be estimated at about 50 per cent. of the peak production of nearly 400 million lbs. in 1929.

Although the United States and Russia are wool-importing countries, their consumption of foreign wool has been declining despite their smaller domestic production, and it is doubtful whether the wool-exporting countries can look for any material extension of their markets there under existing conditions. Fine wool production appears to be still increasing at the expense of the coarser qualities.

HANDBOOK OF TOBACCO DISEASES.

Attention of readers is drawn to the fact that the Department of Agriculture has found it most inconvenient, with the present shortage of staff, to handle the local sales of this book. Arrangements have therefore been made with the Rhodesian Printing and Publishing Company for distribution by them throughout Southern Rhodesia. The book may be obtained from the Herald Store, Salisbury, price 4s., or, postage paid, 4s. 4d.

REPORT OF THE BRANCH OF CHEMISTRY

FOR THE YEAR ENDING 31st DECEMBER, 1932.

General.—During the year under review the routine analytical work that the Chemistry Branch has been called upon to perform has necessitated for its accomplishment the whole time attention of the entire staff.

Despite the fact that early in the year charges were instituted for many services of the branch that had previously been rendered free, the actual number of samples submitted for analysis was greater than that in any previous year in the history of the branch.

It was anticipated that the institution of charges for chemical services would lead to a reduction in the number of these samples, and in view of this and the urgent need for economy, the positions were not refilled of two of the staff, one of whom had resigned during the previous year to fill another post, and another who had obtained extended leave to take up a Beit Railway Trust Fellowship. This anticipation was not realised, and, as previously stated, the amount of analytical work submitted to the branch actually showed an increase.

The position was further complicated by the absence of the Chief Chemist for six months on long leave, and the necessity for the staff of this branch to undertake the most important duties of the Government Analyst who was absent on long leave for seven months of the year.

In order that the large volume of analytical work might be dealt with, the staff have had to neglect many problems requiring investigation and to confine their entire activities to the carrying out of the ordinary routine duties of the branch.

These routine duties may be classified as follows:—

(1) Analyses of soil samples, manures, agricultural limes, waters for agricultural purposes and general agricultural products.

(2) Analyses of samples taken under the "Fertilisers, Farm Foods, Seeds and Pest Remedies Ordinance, 1914."

(3) Cattle dips and toxicological analyses for the Veterinary Department.

(4) Analyses of samples and standardisation of glassware under the "Dairy Produce Act, 1925," and the "Dairy Industry Control Act, 1931."

(5) Advisory work by correspondence and interview.

Summary of Routine Analyses.—The following comprises the samples analysed during the year:—

Soils	324
Manures and fertilisers	18
Farm foods	24
Cattle dipping fluids	45
Toxicological	75
Forensic	41
Waters	27
Barks, charcoal and wood ashes	26
Dairy products	6
Vegetable products	352
Miscellaneous	24
	962

In addition to the actual analytical work, an important activity in the Branch, and one occupying a considerable portion of the time of the senior officers, is the rendering of advice by correspondence and interview on chemical problems. Although the majority of the advisory work is rendered to farmers seeking guidance in connection with soil problems and fertiliser treatment, the Branch is also frequently requested to advise on chemical matters not directly connected with agricultural problems. As far as possible, these requests are complied with whether received from farmers, commercial concerns or other Government Departments.

Lectures to Farmers' Associations, which formerly constituted an important activity of the Branch, have been greatly curtailed, partly on account of the necessity of cutting down expenses and partly because of the pressure of analytical work which required the constant attendance of the staff in the laboratories.

Soils.—Of the 324 samples enumerated under this head, 154—nearly half the number—were submitted for analysis in order to ascertain their suitability for tobacco production, and for fertiliser recommendations for that crop; it is significant that only one sample was sent with a view to the growing of fire-cured leaf on the land, all the remainder being for flue-cured leaf; this is in entire contrast to the position in 1931, where the enquiries were exclusively for the heavier grades.

Thirty of the samples were submitted for advice on maize growing; seventy-two for general advice on miscellaneous crops and sixty-eight were samples requiring special investigation.

Fourteen of these were reported upon for p H. value with a view to ascertaining whether their acidity was at the correct pitch for golf greens, lawns, etc.

A special investigation was made upon three soils submitted at our request from the Senior Forest Officer. It had been noticed at the Mtao Forest Reserve that much superior growth was obtained on soils which had been subjected to intense baking, and the matter being considered as of both scientific and practical interest, a fairly exhaustive analysis was made upon the samples received. The results pointed to an improvement in both physical and chemical properties of the soil as a consequence of the baking.

Four samples of soil were specially analysed for Messrs. Ward and Phillips, New Year's Gift, Umtali, several unusual estimations being made in order to compare the properties of these soils with those of India tea soils. The results were entirely satisfactory, the comparison being most favourable.

A very complete analysis was made on behalf of the Chief Entomologist of three samples of soil, from the Fort

Victoria district. This was to aid him in his investigations as to whether soil conditions had any effect on the prevalence of chafer beetle grubs in different sections of the area in question.

The remaining forty-four of the special analyses consisted of work upon samples taken in connection with an investigation conducted by the Director of Agriculture and a member of the staff on the soil conditions prevailing at the Stapleford Forest Reserve. My opinion regarding the suitability of the area in question for afforestation was embodied in the report of the Director of Agriculture submitted to the Secretary on the 1st August.

Fertilisers.—Only two samples were analysed under the "Fertilisers, Farm Foods, Seeds and Pest Remedies Ordinance, 1914," during the year and both these samples were taken and sent in by the official police sampler at Umtali.

No samples were taken under the Ordinance by officers of this Branch for the reason that it was considered that until the Ordinance was suitably amended, the carrying out of such analyses was merely a waste of time and public funds. Although on several occasions, both in the case of fertilisers and farm foods, samples taken had been found upon analysis to be outside of the limits allowed under the Ordinance, and recommendations from this Branch had been made that proceedings should be instituted, no action was taken against the offenders. After repeated protests being made, the information was received from the Law Department that the regulations were so indefinitely worded that it could not be stated whether certain infringements of the regulations did, or did not, constitute an offence. After consultation with this office, the regulations were amended and the amendments published in the *Government Gazette* on the 11th November, 1932.

Farm Foods.—No farm foods were sampled under the Ordinance for the same reasons as mentioned under "Fertilisers."

Of the twenty-four samples analysed under this heading, nine were carried out for commercial firms, two for private farmers and the remaining thirteen were analysed either at the request of other divisions of the Department or

for our own information and to assist us in our advisory work in connection with the food value of various farm foods.

Cattle Dipping Fluids.—Forty-five samples under this head have been reported upon during the year. Twenty of these represented samples of dip sent in by cattle inspectors according to an arrangement made between the Chief Veterinary Surgeon and the Chief Chemist, whereby cattle inspectors might have the results of their analyses checked by a chemist in order to determine whether their methods and iodine solution were correct.

In the event of the chemist's results not agreeing with the cattle inspector's, the latter's iodine solution is standardised in the laboratory and the factor necessary to correct his solution is given to him, together with an explanation.

Five samples of iodine solution have been standardised during the year in this connection. Nearly all the remaining samples were submitted by officers of the Veterinary Department for analysis under the "Cattle Cleansing Act, 1927."

Toxicological Analyses.—Deaths of animals from arsenical poisoning are as much in evidence as ever. There is no doubt that the majority of the deaths are caused by the careless handling of arsenical dips, although cases of malicious poisoning of cattle by natives do occasionally occur. Seventy-five samples of viscera of animals were analysed during the year, nearly all of which were from suspected cases of arsenical poisoning. In fifty-two cases arsenic was found; in two cases the poison was found to be nitrate of soda, and in twenty-one cases the results of analysis were negative.

Forensic.—Of the forty-one samples analysed under this head, thirty-nine were exhibits forwarded by the Criminal Investigation Department in connection with their investigations into cases of suspected poisoning of Europeans and animals.

The remaining two were exhibits in connection with a case of suspected theft of gold amalgam.

Waters.—Seventeen of the twenty-five samples reported under this head were received from the Irrigation Department in continuation of the soil erosion work with which we have assisted in previous years with the analytical part. Three others came from private farmers seeking advice as to suitability for private irrigation purposes, and the remaining five were miscellaneous samples submitted in order that tests might be made to discover the nature of suspended matter in them, their lime content in connection with boiler feed, etc.

Barks, Charcoal and Wood Ashes.—The twenty-six samples under this head were all analysed in connection with an investigation being carried out by the Forestry Division in conjunction with the Irrigation Division into the most suitable types of wood for use in suction-gas engines. Analyses were made of woods to determine the percentage of charcoal obtainable under standard conditions and the silica and ash contents of these charcoals.

Dairy Products.—Only six of these were dealt with throughout the year under review, four being fat estimations on cheese samples done at the request of the Chief Dairy Officer, who also received a report as regards fat and gelatine content of a sample of ice cream. The remaining sample was one of milk analysed for a local farmer.

Vegetable Products.—During the year 1931, samples of maize grain were subjected to moisture tests to determine whether or not potassic fertilisation exercised any influence on the drying out of maize. In the year under review, similar tests were instituted with lime application instead of potash, and comparisons were also made as to the effect of different methods of applying ordinary fertilisers—broadcasting and direct application in the holes. A full report appeared in the *Rhodesia Agricultural Journal* for September, but here it may be mentioned that no beneficial effects were observable in either one of the comparisons made. Twenty-two samples in all were subjected to determination.

Exhaustive analyses were made of seven samples of tobacco leaf from the Tobacco Research Station in order to determine the influence of chlorine applications to the soil on the composition of the leaf. Varying amounts of

chlorine in the forms of muriate of potash and sodium chloride were applied, the potash being kept constant in the latter application by the addition of sulphate of potash. It was found that the application of chlorine in either form had a very considerable influence on raising the chlorine content of the leaf, and also increased the nicotine, phosphoric oxide and sulphate contents. Another interesting point was that chlorine supplied as muriate of potash had a greater influence on the phosphoric oxide content of the leaf than when supplied as sodium chloride.

Seventy-two wheat samples from different varieties grown by the Plant Breeder at the Experimental Station, Hillside, were subjected to analysis for protein content. From many of these, very high protein figures were obtained, two reaching 17 per cent., but whether this is due to the fact that the varieties were grown on small plots with intensive fertilisation, or whether it is due to the special selective breeding carried out for some years by the Plant Breeder, will require further investigation before definite statements and recommendations can be made.

The remaining samples included several of stack silage from different districts of the country done at the request of the Chief, Division of Plant Industry, in order to assist him in an investigation regarding the comparative merits of the stack and pit methods of preparing silage; samples of pure grasses from the Pasture Research Station, Matopos, the Director of Agriculture and the Senior Botanist; specimens of hay from the Roads Department, the Rhodes Inyanga Estate and private farmers, etc. In addition, two samples of treacle sugars were analysed for invert sugar content, and a report issued on the treatment necessary to prevent inversion taking place.

One hundred and fifty of the samples enumerated under "Vegetable Products" were grasses analysed by the chemist seconded for Pasture Research work. Comments on the resuls of these analyses are referred to in the section under "Pasture Research."

Miscellaneous.—Twenty-four samples were enumerated under this head; six of these were consignments of tobacco seed from private farmers for treatment with silver nitrate

before sowing, and one was a large quantity of lemon seed treated with mercuric chloride solution in order to comply with export regulations to the Union of South Africa.

Experiments on bleaching treatments of peanuts, samples of which in varying degrees of colour, were supplied by the Farmers' Co-op., Limited, were made. A full report on the methods employed and the results obtained appeared in the *Rhodesia Agricultural Journal* for April, 1932.

A full report upon a sample of maize feed suspected of having been adulterated with foreign admixture was forwarded to the Maize Control Board.

The remaining samples included healing oils from the Entomological Department, topping oil for the Chief Engineer, Post Office, etc., none of which calls for special note.

Publications.—The following articles were issued from the Chemical Branch for publication in the *Rhodesia Agricultural Journal*:—

(1) "The Mixing of Fertilisers—A Guide to Methods of Calculation."

(2) "The Bleaching of Pea Nuts."

(3) "The Softening of Waters."

(4) "The Effect of Applications of Lime to the Soil on the Drying-out of Maize."

(5) "Studies on the Improvement of Natural Veld Pastures, No. II."
(Reprinted: Original published February, 1931.)

Investigational Work.—As already indicated, the pressure of routine work has precluded the possibility of any investigational work being undertaken, other than that especially provided for, as in the case of pasture research.

All analytical work carried out for other divisions of the Department in connection with their investigations is classified in this report as part of the routine work of this Branch.

Provision in the Estimates has been made during the past three years for one officer to be seconded for Pasture Research Investigations, and the salary of this officer has been made a direct charge against the moneys allocated to Pasture Research.

For this reason, the officer seconded for these investigations has been allowed to apply his whole time to this work and to be freed from all routine duties.

The grant from the Empire Marketing Board towards the cost of the Pasture Research investigations expires on the 31st March, 1933, and the Board has made it clear that in view of its present financial position, it will not be able to make any extension of the assistance towards this research, but the hope was expressed that the Government would be able to continue the work.

The grant already received has enabled us to equip the two pasture stations properly with housing accommodation, fencing, weigh-bridges, water, farm implements, cattle, fertilisers and staff.

The foundation work of the plan of investigations will, by the end of the present wet season, have extended over a period of three complete growing seasons.

A considerable saving in future expenditure will be possible, as the proposed plan of fertilisation has now been completed, the Pasture Research Botanist has completed her contract, and the Chemist will return to duty where his services are urgently required, although it is hoped that sufficient time will be available to him to carry out any analyses that may be required in future in connection with these investigations.

Research into the Improvement of Natural Pastures: *Pasture Research Station, Matopos.*—The work on this station has now been in progress for three years on the Blackland paddocks and for two full years on the Sandveld section. The interpretation of the results has been made exceedingly difficult owing to the fact that a severe drought was experienced at Matopos last year at the most critical period in the growing season.

Although good rains fell during the early part of the season, a total of only 1.26 inches was precipitated between the 14th November and the 15th January, and only 0.02 inches between the 17th March and the 21st April. The first long drought exercised a very adverse influence on the hay crop, many of the earlier grasses which had started off

well coming into seed when only a few inches high, and the later grasses being badly burnt and their subsequent growth severely delayed. Instead of obtaining a yield of hay of from 8 to 13 tons from each ten-acre paddock as in the previous year, the total yield from six ten-acre paddocks only amounted to 7½ tons, an average of 250 lbs. per acre.

In order to assure of having a sufficiency of hay to carry the animals on the station right through the dry season, it was necessary to stump out more land on a previously unused section of the estate, and to cut hay wherever possible. Good rain fell during the first two weeks in March, but they were too late to allow the hay paddocks completely to recover, although they brought on a fair aftermath which provided a certain amount of good grazing for the cattle. It is of particular interest to note that all the cattle on this station, although receiving no supplementary feed or mineral licks in addition to their hay ration, kept in good condition right through the dry season, and although the weights of the mature animals fell, and the calves' rate of growth was considerably inhibited as compared with their increases during the rainy season, the animals looked exceedingly fit at the end of November, although they had had no green grass for six months.

The general condition of the animals in the control, superphosphate and rock phosphate groups, was very uniform, and, although good, was distinctly inferior to that of the animals in the phosphate and potash (P.K.) and the phosphate, potash and nitrogen (N.P.K.) groups. The animals in the latter group were outstandingly superior to all of the groups, although for at least five months of the year they had been receiving exactly the same hay as all the other groups, the yield from the fertilised paddocks being only sufficient to maintain them for seven months of the year.

This definitely points to some superiority in the value of the grass obtained during the rainy season from the paddocks receiving complete fertiliser. None of the animals showed any craving for salt or other minerals.

Results of Chemical Analysis.—

Matopos.—The grasses taken for analyses from this station during 1932 comprised samples of hay from the limed and unlimed portions of the hay paddocks, and samples from the grazing paddocks cut at the time of hay-making on the corresponding hay paddock.

Complete analyses of thirty-five samples were carried out.

Blackland.—The limed portion of the paddock receiving a complete fertiliser, gave a slightly better quality of hay than the unlimed; there was no noticeable difference in the other paddocks. Comparing the nutritive value of the hay from the various paddocks, it is not possible to state that there were any significant differences between the fertilised paddocks, although the hay from the paddocks receiving complete fertilisers was in general the best; the control was appreciably inferior in quality. Samples from the grazing paddocks were in all respects better than those from the corresponding hay paddocks. This is no doubt due to the close grazing, which maintained a young and succulent pasture. The hay cut in 1932 showed a definitely better analysis than that in 1931.

Sandveld.—The analyses failed to show any benefit from the application of lime. The P_2O_5 content of the hay from fertilised paddocks was greater than from the control, indicating a response to phosphatic fertilisers. There was no other significant difference in the hay from the various paddocks. On this area also, the samples from the grazing paddocks were definitely better than those from the hay paddocks. The hay in 1932 was much better than in 1931 in all respects on all paddocks. It would appear, therefore, that the general pasture management and fertilisation are having a marked influence on the feeding value of the herbage.

Pasture Research Station, Marandellas.—Reference was made in last year's report to the fact that the carrying capacity at this station had been brought down from one beast to twenty acres, to one beast to nine acres.

During the year under review, the influence of stumping and controlling the grass by cutting and grazing had so

materially improved the veld that the carrying capacity was still further increased.

The number of animals carried on each set of paddocks (80 acres) was twenty-six, and comprised seven cows, four steers, five calves and ten sheep. Eighty head of cattle and fifty sheep were, therefore, carried for the whole year in the five groups on the 400 acres of experimental land. In addition, a surplus of over forty-five tons of hay was obtained from the same 400 acres.

The results from this station show many points of difference to those obtained at Matopos.

Owing to the large acreage of this station and the more consistent rainfall, the quantity factor of the grazing and hay has presented no difficulties, and the cattle in each group have easily been carried through the year on their respective paddocks.

A point of great interest was the general condition of the cattle on this station, as compared with the animals at Matopos. Although the quantity factor was unlimited at Marandellas and the animals were allowed to eat to the limit of their appetites, the cows in all groups were in very poor condition at the end of the dry season, while the tollies and calves, although having lost weight, were still in very fair condition. This is an entirely different picture to that pertaining at the end of the dry season in the previous year, when the heifers as well as the tollies were in quite good condition at the end of the dry season.

The poor condition was particularly marked in the case of the cows in the control, rock phosphate and superphosphate groups, nearly all of which showed symptoms of loss of appetite and a great craving for salt. Their coats were rough and staring, and one or two appeared extremely emaciated and were hardly able to stand. The cows in the phosphate and potash, and in the complete fertiliser groups, showed similar symptoms, but the onset was much later in the year than in the case of the other groups.

The condition of these animals appeared very similar to those described in a recent publication from America for animals suffering from "Salt Sick," which is a nutritional

anaemia in cattle and is found to occur in animals whose feed consists chiefly of grass forage on certain white and grey sandy soils of Florida. It is stated that the addition of iron and traces of copper to the feed of affected animals cured the disease in all but the most advanced cases. In order to ascertain whether the cows at Marandellas were suffering from anaemia, tests were made to determine the haemoglobin content of the blood of the animals. The majority of the cows had a percentage figure for haemoglobin of 60. Although this appeared very low, it was necessary to obtain figures from healthy stall-fed animals as a comparison. No such animals being available on the Pasture Research Station, a request was made to the Director, Rhodes Matopo School of Agriculture, for similar tests to be made upon pedigree stall-fed animals at the Government Farm, Matopos. The tests were kindly made by the Animal Husbandry Officer at Matopos on six animals, and the percentage haemoglobin was found to be 80 per cent. in four animals and 90 per cent. in the other two. Prior to these figures being available, two of the worst cows were picked out at Marandellas, one of which was dosed with iron citrate and the other with iron citrate and salt. These animals were dosed daily for a week at the end of October, and then every other day for a second week. By the end of November both of these cows had improved markedly in condition and had put on 60 lbs. in weight in the case of the animal receiving salt and iron, and 40 lbs. in the animal receiving iron alone. The haemoglobin content of the blood rose to 80 per cent. in two weeks.

This investigation is being pursued further, and will be more fully reported upon at a later date.

New grass became available early in December, and the animals in all groups improved rapidly in condition. It was noticeable, however, that the animals in the P.K. and N.P.K. groups recovered condition much more rapidly than those in the other groups.

An additional point of interest in connection with the animals at Matopos as compared with those at Marandellas is that while the former show no craving for salt—and even when this is put in front of them they take little notice of

it—the animals at Marandellas show a great craving for salt and devour it ravenously.

In view of the fact that the cows at Matopos were maintained in good condition and the cows at Marandellas were steadily losing weight, although the hay on both stations was very similar in composition as regards their protein, carbohydrate and fat content, it was decided to forward hay from Marandellas to Matopos to ascertain whether the cows at the latter station would also go down in condition when fed this hay.

Twenty-five tons of hay were, therefore, sent to Matopos, and it was found that the cows, when fed on this hay, did equally well as when getting hay cut at Matopos.

This result points quite definitely to some deficiency other than protein, carbohydrate and fat in the Marandellas hay. In view of the craving for salt in all the Marandellas animals, it would appear that this deficiency is probably of a mineral nature. This would account for the fact that the Matopos cows showed no falling off in condition when fed the Marandellas hay, as they would probably have a sufficient reserve in their bodies to carry them through the period they were being fed on the mineral-deficient hay.

Yields of Hay, Marandellas.—The results of fertilisation have been more marked in the yields of hay obtained from the various paddocks in 1932 than was the case in 1931. The following table shows the average yields per acre for the two seasons:—

Treatment.	1931. Lbs. per acre.	1932. Lbs. per acre
Nitrogen + potash + superphosphate ...	1,183	1,630
Potash + superphosphate	875	1,310
Superphosphate	870	1,034
Raw rock phosphate	627	960
Control	890	950

It should be noted that in both years the rainfall was very satisfactory and the pastures received no setback during the growing period.

In 1931 the paddock receiving a complete fertiliser was the only one showing a definitely increased yield. In 1932,

however, not only has the yield from each treatment increased appreciably, but the increase in the case of the fertilised paddocks has been greater than on the control, with the result that the nitrogen, plus potash plus superphosphate, paddocks showed an average increase of 71 per cent. over the control, and the potash plus superphosphate an increase of 38 per cent.

Results of Chemical Analysis.—

Marandellas.—During the year 115 samples were analysed from this station. In addition to comparing the value of the pasture on the paddocks receiving different fertiliser treatments, a full investigation was carried out on the effect of lime and of doubling the dressing of superphosphate on various paddocks. To do this, random samples were taken each month from December, 1931, to May, 1932, inclusive, from the limed and unlimed portions of five paddocks, and a similar set of samples from three paddocks, one-half of which received the normal dressing of superphosphate and the other half received a double dressing. Other grasses analysed comprised ten samples of hay and six samples from a raw rock paddock which did not have any further treatment superimposed on one-half of it.

In general, it was found that the application of lime to the control, superphosphate, potash and superphosphate paddocks did not materially affect the feeding value of the pasture. Further, there was no significant difference between the samples from these paddocks. On the paddock receiving a complete fertiliser, nitrogen plus potash plus superphosphate, however, the analyses showed a definite improvement. This would indicate that on poor soils of the type at Marandellas, it is necessary to apply a complete fertiliser plus a liberal dressing of lime before benefit can be expected.

On the paddocks receiving the double dressing of superphosphate, the only noticeable effect due to the additional superphosphate was in the P_2O_5 content of the grass, but the increase would not appear to justify the extra cost. The samples from the raw rock paddock were comparable with the others receiving the normal fertiliser treatments.

One set of five of the hay paddocks was cut early in February and the remainder in the middle of March, the latter being grazed until January, so that the hay cut on these paddocks was no more mature than that cut in February. The analyses of the March samples are better than the February ones, which is probably due to a more evenly distributed rainfall during this growing period. This is in accordance with earlier conclusions that it is the stage of maturity of the pasture rather than the season of the year which determines its feeding value.

In both sets there is practically no difference between the samples from the fertilised paddocks, all of which are better than the corresponding control. The fertilised hay shows an improvement on that cut in 1931, and the control is very similar to the average of the 1931 samples.

Comparing the analyses from the two stations, it was noted that the Blackland pastures at Matopos had, in general, a higher feeding value at the same stage of growth than the Sandveld and the Marandellas pastures, which were very similar. An important difference between the two stations was in the chlorine content of the herbage, that at Matopos being markedly higher than at Marandellas.

In addition to the analyses of mixed pastures, two samples of rapoko grass, one from Marandellas and the other from Sandveld, Matopos, were analysed. These confirmed previous opinions of the high feeding value of this grass.

Acknowledgment.—Acknowledgment is made of the loyal manner in which the staff have co-operated to meet the heavy demand made upon the Branch right through the year.

A. D. Husband,
Chief Chemist.

A. verecunda.

NOTES ON AFRICAN ALOES.

By H. Basil Christian, Ewanrigg, Arcturus.

PART IX.

Aloe Verecunda.—*Aloe verecunda* belongs to Berger's Leptoaloe section. It is found on the Wolkberg near Haenertsberg in the Zoutpansberg district of the Northern Transvaal, in the mist belt, and also in the Middleberg district of the Eastern Transvaal.

It is a pretty little aloe with its peach-red flowers in a dense capitate raceme, and thrives under Southern Rhodesian conditions, flowering here in December and again in February, March, April and into May. The flowers last longer than most of the many aloes in this section. It increases rapidly by means of suckers from its base into small clumps.

It is described and illustrated in "Flowering Plants of South Africa," pl. 124.

Description: Stem short, leaves 8 to 10, distichous, dicidous, 25 to 35 cm. long, 8 to 10 mm. broad at the base, narrowly linear, distinctly channelled, rounded at the back, with numerous raised white spots at the base, with delicate white teeth 2 to 7 mm. apart.

Peduncle stout, 25 cm. long, clothed with broad, ovate, shortly cuspidate green empty bracts.

Raceme capitate, dense. Bracts 20 mm. long, and 15 mm. broad, ovate-acute. Pedicels 25 mm. long.

Perianth peach-red to scarlet (R.C.S.), greenish towards the apex, 26 to 30 mm. long, 12 mm. dia., straight, very markedly 3-angled, contracted towards the mouth; segments free.

Styles or stamens not or scarcely exserted.

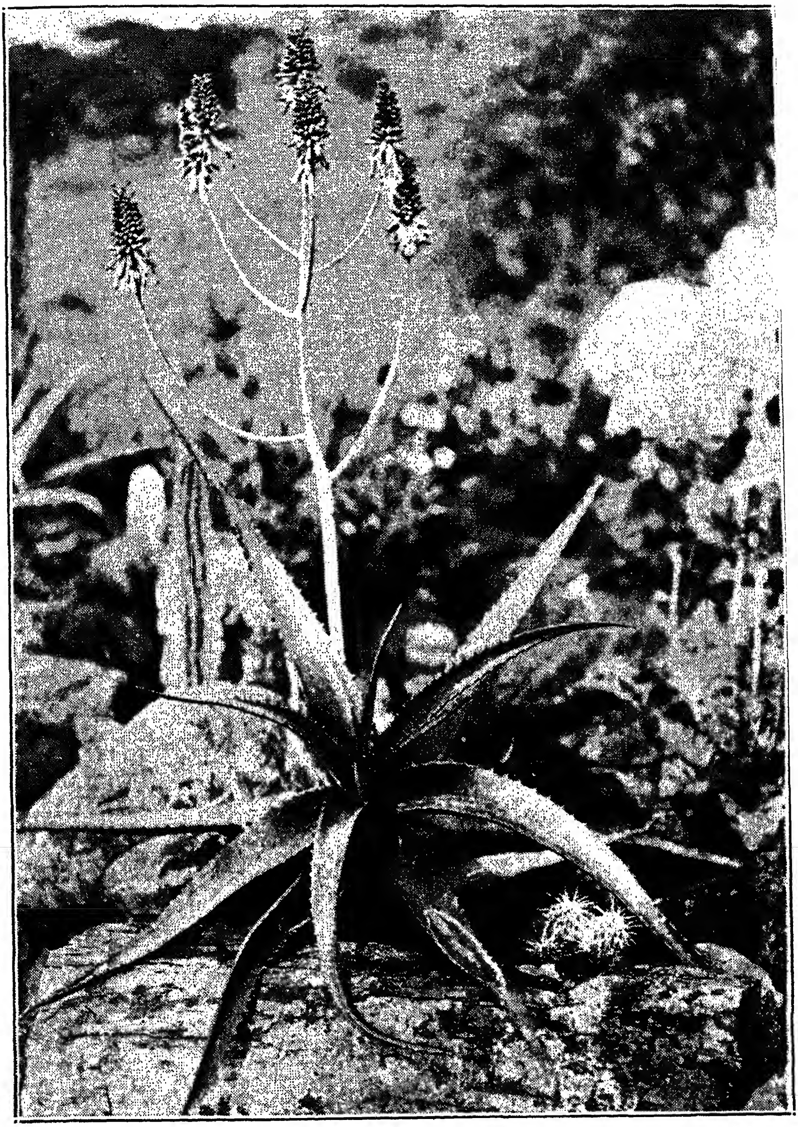
Aloe Eru.—*Aloe eru* belongs to Berger's section "*Aethiopicae.*" At first sight, especially when not in flower, it bears a strong resemblance to our *A. Hildebrandtii.* It comes from N.E. Africa, being found at Chinda, Eritrea; Asmara; Cheleb and in Nubia between Atbara and the Red Sea.

It has been grown for some years in Durban, and does very well under Southern Rhodesian conditions, flowering here in September and October.

There are four named varieties in addition to the type:—

1. *A. eru var. maculata.*—Leaves smaller, narrower, spotted on both sides, marginal spines large and remote.
2. *A. eru var. erecta.*—Leaves narrower, the young ones spotted, bright red line along margins.
3. *A. eru var. glauca.*—Similar to *var. erecta,* but the leaves thicker.
4. *A. eru var. parvipunctata.*—A smaller form with the leaves copiously spotted on both sides with small round spots.

Description: Stem branched from the base, 40 to 50 cm. long, ascending. Leaves densely rosulate spreading arcuate-reflexed, ensiform from the base, 4 to 7 cm. broad, gradually acuminate, about 40 to 60 cm. long, very fleshy, somewhat concave above distinctly canaliculate towards the apex, strongly convex below, 15 to 20 mm. thick, sometimes keeled and with a few minute prickles at the apex, bright green sometimes shining, often sparsely spotted on both sides, especially below, and in young plants everywhere with copious white oblong or linear spots, at the margins lined with a thin red line armed with deltoid spreading or hooked reddish teeth turned up, 4 to 5 mm. long, 12 to 13 mm. apart. Inflorescence 1 to 2 m. high, scape rather slender, longer than the leaves, repeatedly dichotomously divided above; branches slender arcuate-erect, clothed above with a few small empty deltoid subulate empty bracts 2 to 4 mm. long; racemes subdense, 8 to 15 cm. long, the terminal often elongated to 24 cm., bracts small, spreading deltoid-subulate, one nerved 2 to 4 mm. long; pedicels 11 to 15 mm. long, slender, spreading, arcuate-erect from the base; perianth 15 to 19 mm. long, yellow, the base and often the whole of it golden, the base stipitate, above the ovary lightly constricted, from there



A. eru.

A. saponaria.

campanulate-cylindric, with the outer segments longer than the tube, ovate oblong, 3 nerved, somewhat acute, the inner more obtuse; filaments unequal, shortly exserted. Capsule oblong, rotundate-trigonous, small, about 15 mm. long.

Aloe Saponaria.—*Aloe saponaria* belongs to Berger's section *saponariæ*. It occurs on the south and east coasts of the Cape from Hermanus eastwards, and is described in "Flowering Plants of South Africa," pl. 96.

This is one of the ten species sent to Europe by the Governor Adrian van der Stel, and was described by Casper Commelin in the "Horti Medici Amstelodamensis" in 1701.

It is one of the spotted leaf aloes, being found in three colour varieties: salmon-pink, red and yellow, and with its robust stems, dense capitate heads and glossy flowers makes a fine show in any rock garden. It suckers freely and thrives under Southern Rhodesian conditions, flowering from April to July.

Description: An acaulescent plant, or with a short stem with a rosette of leaves.

Leaves up to 20 cm. long, about 8 cm. broad, dark green with dark longitudinal marking on the upper surface, lighter green and faintly spotted beneath, acuminate, usually brown and withered at the tip, with spines on the margins; spines 8 mm. long, about 1.5 cm. apart, and more or less at right angles to the leaf.

Inflorescence .3 to .5 m. high, simple or branched. Peduncle terete with a few dry membranous, acuminate bracts. Flowers in a contracted raceme. Floral bracts 1.5 to 2.5 cm. long, long acuminate from an ovate-lanceolate base. Pedicels 2.5 to 4 cm. long, terete.

Perianth tube 3.3 cm. long, 9 mm. dia. above, gradually narrowing below and dilated into a globose base; segments 1 cm. long, 5 cm. broad, oblong, obtuse, slightly reflexed in the mature flower.

Filaments in the buds 2.4 cm. long, linear, in the mature flowers lengthening to 3.5 cm. long and becoming corrugated in the upper half. Ovary 8 mm. long cylindric; style 2.5 cm. long, cylindric, lengthening in the older flowers to 3.8 cm.; stigma simple.

MYCOLOGICAL NOTES.

SEASONAL NOTES ON TOBACCO DISEASES.

6. An Unusual Type of Frog Eye Spotting.

By J. C. F. Hopkins, B.Sc.(Lond.), A.I.C.T.A.,
Government Plant Pathologist.

The somewhat unusual weather conditions which have been experienced during the past six months have been responsible for a certain amount of variation in the symptoms exhibited by some common tobacco diseases. In some instances the variations from normal have been so great that experienced growers have been completely deceived as to the identity of the diseases attacking their crops. I have even received reports from one district of a new disease appearing in epidemic form on the ripening leaf which, on microscopic examination, proved to be Frog Eye (*Cercospora nicotianæ*).

As a result of the uninterrupted cold, wet period of a month or more in duration which was experienced in many districts at the beginning of the year, newly planted tobacco did not make the accustomed rapid growth, and nearly everywhere the plants became yellow in colour. Not uncommonly the young plants were covered by weeds which had been allowed to get out of hand. It was not surprising, therefore, to find the lower leaves severely attacked by leaf spotting organisms, chief among which was the Frog Eye fungus. The typical brown, white-centred spots were numerous and conspicuous on the upper leaves, but were fewer in number and not easily detected lower down the plant. Instead were to be found large chestnut-brown blotches which, in the case of plants surrounded by weeds, encroached upon and finally destroyed the almost white bottom leaves, leaving them as limpid brown shreds hanging from the stalk.

Light brown zonate spotting of an unusual type caused by the Frog Eye fungus *Cercospora nicotiana*.

Frog Eye in this form does not usually occur in the field. but is comparable with the disease as it appears on the lower leaves of seed-bed plants which have been allowed to become chlorotic, either as a result of excessively thick sowing of seed or fertiliser deficiency. With the cessation of the rains and the advent of sunny weather, cultural operations were recommenced and the tobacco began to grow, soon regaining its normal appearance. Where bacterial diseases (Angular Spot and Wildfire) were absent, the plants were supposedly healthy, and it was not until the leaf commenced to ripen later in the season that fungus spots were again in evidence.

During the interval between the cessation of the rains and the ripening of the crop, a severe drought was experienced in many tobacco-growing areas, and the development of the lower leaves was not completed before they began to turn colour. In other words, the leaves did not ripen normally, but merely became chlorotic (yellow) as a consequence of impaired metabolism. Such leaf is deficient in gum, thin in "body" and possesses a harsh texture; it is markedly deficient in starch when tested with iodine. As is usual under conditions of drought, the tissue between the main veins of the leaves died, causing the symptoms of "sun scorch," "firing" and "drought spot" to appear. The amount of leaf destroyed in this manner is probably greater than normal this year, following the very adverse growing conditions experienced by the early crop.

In addition to and what may be confused with these manifestations of drought are spots of varying size caused by fungi. The apparently unknown new disease referred to earlier in this article is a case in point. Samples submitted to me for examination showed almost typical symptoms of Brown Spot* (Alternaria Leaf Spot). The lesions ranged from one-eighth of an inch to one inch in diameter, were chestnut brown in colour, with very thin dark brown margins and small dark brown central areas. Indistinct zonations were also present. Very rarely the central areas were lighter in colour than the immediately surrounding dead tissue, and sometimes broad, bright yellow bands occurred between the spot and the green tissue. Other

* *Alternaria longipes* (Ell. & Ev.) Tisd. & Wadk.

specimens, collected in and near Salisbury, showed large circular or elongate, light brown lesions with pronounced zonations. and small dark centres, in which could be seen, with the unaided eye, an almost black, powdery mass of fungus spores (Fig. I.). The spots were not surrounded by bands of bright yellow, although the cells bordering the dead areas were somewhat chlorotic.

Microscopic examination proved the two types of spot to be caused by the same organism, namely, the Frog Eye fungus, and it is very interesting to note that not only were the symptoms of the disease abnormal, but the fungus itself produced spores and spore-bearing branches of unusual dimensions.*

The appearance of abnormal leaf spots must undoubtedly be attributed to the unfavourable weather conditions with which the crop had to contend. Excessive and prolonged rainy weather, accompanied by overcast skies and low temperatures inhibited the formation of the green colouring matter (chlorophyll) in the leaf, so that when a prolonged drought set in the natural resistance of the cells had been so lowered that parasitic fungi were able to develop almost unopposed in the weakened tissues. Thus, in place of the usual small spot bounded by a distinct margin which is the familiar symptom of Frog Eye, relatively large lesions occurred, surrounded by yellow areas of already dying cells, simulating the type of lesion usually associated with Brown Spot.

From the point of view of control, the actual identities of these fungus diseases are unimportant. Efficient cleaning of lands at the end of the season combined with crop rotation, seed-bed spraying and *early* priming are equally essential, whether the disease go under the name of Frog Eye or Brown Spot.

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* The measurements for conidiophores are 30 to 50 x 4 to 6 microns, and for the conidia 50 to 65 x 3 to 5 microns. Conidiophores and conidia of the same dimensions were observed on a few typical Frog Eye spots which occurred on the abnormal material. My measurements for the conidiophores of normal *Cercospora nicotianæ*, as it occurs in Rhodesia, are 75 to 100 x 4 to 5 microns, and for the conidia 38 to 135 x 2.5 to 3 microns.

SALISBURY AGRICULTURAL EXPERIMENT STATION.

ANNUAL REPORT, 1931-32.

By H. C. Arnold, Manager.

(Published with the Authority of the Chief, Division of Plant Industry.)

Although the rainfall during 1931-1932 was about six inches less than the average, the uniformity of its incidence and the copious precipitations toward the end of the season which alternated with periods of sunshine, produced conditions particularly suitable for the production of maize and similar crops, and heavy yields were recorded. Early planted ground nut crops were damaged by the late rains, which caused the nuts to sprout and interfered with harvesting operations. The season was a very unfavourable one for oats, which suffered from the somewhat droughty conditions prevailing in December and early January, which appear to have reduced the ability of the oats to resist rust attack.

Analysis of Rainfall, 1931-32.

Month.	No. of rain days.	Total for month.	No. of rains over ¼″	Total to end of month.	Periods exceeding one week without rain.
October	2	1.33	1	1.33	
November	13	6.22	8	7.55	22nd Nov. to 29th Nov.
December	12	3.75	4	11.30	24th Dec. to 1st Jan.
January	14	4.34	4	15.64	4th Jan. to 13th Jan.
February	15	3.77	7	19.41	
March	12	3.09	5	22.50	17th March to 6th April.
April	11	3.68	3	26.18	
May	4	.44	1	26.62.	

The November rainfall was exceptionally heavy and amounted to twice the normal average total, but the precipitation during December, January and February was considerably below normal, a feature of the rains in these months being the absence of heavy falls. Only once in December, and twice in January, were precipitations of one inch or over recorded, and by the end of March—the close of the normal rainy season—only 22.5 inches had been recorded. The amount of rain which fell in April was very exceptional, and on the 26th of that month the heaviest fall of the season occurred, totalling two inches during the 24 hours.

The results of experiments conducted at this station since 1919-20 are available for reference in bulletin form, and to facilitate comparison this report is drawn up on similar lines to previous ones.

For reasons of economy or owing to their having served their purpose, the following experiments were discontinued:—

1. The comparison of the first crop of sweet potatoes with the volunteer crop of the following season.
2. The effect on the stand, of harrowing young maize with spike harrows.
3. The effect on the yield of grain of top-dressing the maize crop with nitrate of soda.
4. The comparison of various methods of surface cultivation of maize.
5. The comparison of species of sesbania with sunn-hemp for green manure.
6. The comparison of methods of pruning sunn-hemp to increase the production of seed.
7. The comparison of various leguminous crops for hay.
8. Summer wheat variety trials.
9. Green manuring for potatoes.
10. Linseed variety trials.
11. Liming trials, series I., II. and III.
12. Rotations including tobacco.
13. Maize alone versus maize and legumes combined for silage.
14. Canna interplanted with legumes.

No new investigations were commenced, but a considerable increase was made in the number of selections of sunn-

hemp under trial with a view to isolating strains which produce seed more freely than the common stock. Similar work with soya beans, which has for its object the segregation of strains more suited to the needs of Rhodesian stock farmers was augmented.

An interim report on investigations dealing with pasture and hay grasses was published in the December issue of this journal.

CROP ROTATION EXPERIMENTS.

First Series, 1913-32.

Maize Yields in Bags per Acre.

System of Cropping.	1931-32 rainfall 26.62 inches.	1930-31 rainfall 31.47 inches.	1929-30 rainfall 23.46 inches.	1928-29 rainfall 31.62 inches.	1927-28 rainfall 26.63 inches.	Average yields.
* A1. Maize continuous green manured, plus 250 lbs. per acre bone meal and 19 per cent. supers in 1928-29 (18th year)	9.60	12.60	15.88	Green manure ploughed under.	1.90	...
* A2. Maize continuous, 250 lbs. per acre bone and supers to the maize in 1928-29 (18th year) ...	10.92	2.99	11.44	6.20	...	...
† B. Alternate maize and bare summer fallow; no manure or fertiliser	10.02	1.95	6.43	5.65	8.15	10.05
C. Three-course rotations: maize, dolichos beans (reaped), oats; no manure or fertiliser	11.1	11.70	11.36	12.00	12.15	14.56
D. Four-course rotation; maize (plus 6 tons dung per acre), oats, dolichos beans (reaped) maize; average of 2 maize plots	16.33	14.93	15.79	19.00	17.45	...
Maize (no manure direct)	14.80	14.95	13.25	21.35	14.10	18.09 (16 years)
Maize (dunged plots)	17.85	14.90	18.33	16.65	20.80	19.35

* Note.—*Having grown maize for 15 years in succession without manure or fertiliser, during which time its yields had gradually decreased until they had become so low as under practical field conditions to have rendered them negligible, this plot had served its purpose. With the object of comparing two methods of again raising the cropping power of such land to a more profitable standard, the whole plot was treated with a mixture of one-third bone meal and two-thirds superphosphate at the rate of 250 lbs. per acre at the beginning of 1928-29 season. One-half of the plot was then planted to maize, while the other half was sown to a mixture of Sunn hemp and velvet beans, which were subsequently ploughed in.*

† *In 1929-30 this system was amended from "Alternate Maize and Bare Summer Fallow" to "Alternate Maize and Dolichos Beans for Hay."*

Comparison of the yields obtained during the season under review with those of previous seasons reveals in a very striking manner the effect which seasonal changes exert on the productivity of soil which lacks humus and has been sown to the same crop for a number of years. Conversely these returns also prove that by practising a balanced rotational system of cropping, while maintaining the phosphate and humus content of the soil, the farmer may acquire comparative immunity from the effects of unfavourable seasons.

System A.—Owing to favourable weather conditions Plot A 2, which has never received humus in any form, yielded nearly four times as much grain as in the previous season, but even so, its yield was little more than that of the plot green manured, which has consistently produced good crops every season since the green manure was ploughed under three years ago. In the second series of rotational trials, to which reference is made later, it is shown that a single dressing of 200 lbs. of phosphatic fertiliser at intervals of fours years is insufficient to maintain fertility, and it may be inferred that the somewhat lower yield from Plot A 1 during the past season was caused by the deficiency of phosphates due to the heavy crops produced in the two previous years.

During the four-year period 1929-32, the plot which was green manured has yielded 6½ bags per acre more than the plot which received fertiliser only.

System B.—The yield obtained in this system is five times as much as that of last season and supports the result obtained in System A in showing the effect of favourable weather conditions on the yield of soil which has been depleted of its organic matter by continuous cropping with the same kind of crop without the restoration of phosphate or humus. When the returns over a period of years are compared, it will be seen that such heavy yields in a favourable season may prove misleading to the farmer, and that when a series of unfavourable seasons is experienced he will be disillusioned and astonished by the realisation of the extent to which his land has become impoverished.

System C.—In spite of much higher yields of maize having been taken from these plots in previous years, their

productive power is still above that of the plots on which maize has been grown continuously. This experiment indicates that in contrast to a single crop system, when a balanced rotational system of cropping is adopted, the fertility of the land can be maintained at a high level for a long period, and that the yields are less erratic, being only slightly affected by seasonal variations. To some extent at least crop rotation makes every season a favourable one.

System D.—The remarkable effect of the application of a small dressing of farmyard manure is shown in this system. During the past three years the three plots in system C have yielded 11.38 bags per acre per annum, and in the same period the four plots in System D have yielded 23.52 bags per acre per annum, showing that the yield of maize in the manured system is double that of the unmanured system. When it is remembered that this rotation also yields heavier crops of oats and bean hay, it will be seen that the beneficial effect of the small dressing of yard manure is very great, and that its careful preservation and utilisation cannot be too strongly urged.

Second Series of Crop Rotations.—These rotations were laid down in 1919-20 and were designed to evolve a system of cropping which would meet the needs of farmers who could not adopt mixed farming. The series included two plots, A and F, on which maize was grown continuously for ten years without manure or fertiliser to serve as checks on the results from the rotations. For this purpose the cropping of plot A continues as in the past, but on plot F, commencing season 1929-30, fertiliser is applied in alternate years. The fertiliser treatment given to this plot is the same in quantity and quality as that accorded in rotational System H, but green manuring is entirely omitted.

Plot A: System E.—Maize continuous without manure or fertiliser:—

Seasons and Yields of Maize in Bags per Acre.

1931-32	1930-31	1929-30	1928-29	1927-28	1926-27	Average over 13 years
11.60	2.33	7.85	7.65	6.5	10.6	11.41

With the exception of the season 1925-26, when the yield of this plot was 12 bags per acre, this season's crop is the heaviest recorded since 1922, when the yield was 13 bags per acre. The average yield for the four seasons preceding the one under review was 6.05 bags per acre, and for the four previous years was 9.05 bags per acre; the exceptionally high yield obtained this year is seen to be due entirely to the exceptionally favourable climatic conditions.

Plots B to E: System F.—Three-quarters of the land under maize, one-quarter under Sudan grass. Each year one section under maize, commencing with Plot B in 1919-20, receives eight tons of farm manure per acre, and commencing on Plot E in 1929-30, the section which grew Sudan grass the previous season receives 200 lbs. per acre of superphosphate (19 per cent. P_2O_5).

Maize Yields in Bags per Acre

	1931-32	1930-31	1929-30	1928-29	1927-28	1919-20	Average 1920-32
Plot B ...	22.65*	9.10†	Sudan g.	14.55	17.00*	26.0	18.65
Plot C ...	19.33†	Sudan g.	13.33	10.15*	8.50	23.0	15.78
Plot D ...	Sudan g.	9.10	15.78*	9.55	Sudan g.	Sudan g.	17.02
Plot E ...	19.23	13.42*	13.90†	Sudan g.	11.60	24.6	16.64
Average	20.41	10.54	14.34	11.42	12.36	24.7	17.02

* Indicates the application of farmyard manure.

† Indicates the application of 200 lbs. per acre superphosphate.

All of the plots in this rotation returned high yields during the season under review. The average yield of 20.41 bags per acre being considerably higher than for several years indicates that the effect of the addition of superphosphate to the manurial scheme is now being more fully revealed. The plots cropped to maize this season have all received the phosphate dressing at some time during the past three years in addition to the usual dressing of farmyard manure, and there is no doubt that this, combined with the favourable weather, is the reason for the uniformly high yields obtained. It may be noticed that on Plot B, which last year produced the comparatively low yield of 9 bags per acre, in spite of the application of 200 lbs. of superphosphate, the high yield of 22.65 bags has been reaped this season. In this case a portion of the fertiliser appears to

have remained inactive in the first season, but the application of yard manure, in addition to favourable weather, has made the phosphate available for the use of the plants, and the result is seen in the heaviest crop produced in this rotation during the past ten years. Comparison of the yields from these plots during the past three seasons shows that in spite of the regular use of phosphate and farmyard manure the seasonal effect has been greater here than in Systems C and D, in which comparative immunity to seasonal fluctuations has been noted. This is apparently due to the ill-balanced nature of the system in which the requirements of the crops are the same in every case, and it is therefore virtually a one-crop system.

Plot F: System G.—Maize continuous. No manure or fertiliser during the first ten years. Commencing season 1929-30, fertiliser consisting of one-third bone meal and two-thirds superphosphate at the rate of 200 lbs. per acre is applied every alternate year.

Seasons and Yields of Maize in Bags per Acre.

1931-32	1930-31	1929-30	1928-29	1927-28	1919-20	Average over 12 years
21.08*	7.03	6.38	6.1	4.8	23.3	12.12

* Indicates the application of 200 lbs. per acre fertiliser.

Fertiliser of the same kind and in the same quantities is applied to this plot as in System H below, but in this case no humus, either in the form of farmyard or green manure, is given. In this way information regarding the practicability or otherwise of profitable maize production on soil lacking humus though amply supplied with phosphates should be provided.

A remarkably heavy crop was reaped on this plot during the season under review. Because of this the question as to whether investigation into the need of humus is necessary seems justified. Examination of the yields recorded during the previous seasons shows that the fertiliser applied in 1929-30 had little effect, either during the season of application or in the following one; it appears to have remained inactive and unavailable to the crop until the arrival of suitable climatic conditions, these chanced to occur at the time

a second application of fertiliser became due and the combination of these factors appears to have enabled this land to produce a very heavy crop this season.

Plots G to K: System H.—Three-quarters of the land under maize, one-quarter under velvet beans, which are ploughed under for green manure. From the commencement of this experiment until 1928-29 this land received one green manuring and one application of fertiliser during each period of four years. The returns from these plots showed that insufficient plant food had been supplied to maintain fertility, and the manurial system was then amended to provide for two dressings of fertiliser during each four-year period. The crop of maize which follows the green manuring now receives 200 lbs. of 19 per cent. superphosphate per acre, which should enable it to make better use of the nitrogen supplied by the green manure; the second maize crop receives no fertiliser, and the third crop, that immediately in front of the green crop, receives 200 lbs. per acre of a mixture of bone meal and superphosphate. Under the revised system it is anticipated that heavier green manure crops will be available for ploughing under, and this, combined with the additional application of artificials, should result in a satisfactory maintenance of soil fertility.

Yields of Maize in Bags per Acre.

	1931-32	1930-31	1929-30	1928-29	1927-28	1919-20	Average 1920-32
Plot G ...	12.75	16.80*	Beans	8.75	14.50*	23.10*	15.67
Plot H ...	22.45*	Beans	10.70*	9.00	14.40	23.00	16.25
Plot J ...	Beans	6.10*	7.57	17.50	Beans	Beans	15.07
Plot K ...	16.50*	7.53	16.00*	Beans	7.80	19.20	14.71
Average ...	17.23*	10.14	11.42	11.75	12.23	21.70	15.42

* Indicates application of fertiliser.

* Plot H, on which the application of superphosphate follows green manure, yielded 22.45 bags per acre. This is nearly equal to the yield obtained in System F, farmyard manure plus the residue of superphosphate from the previous year's application. In both systems the highest yields were obtained from the plots which received both humus and phosphate.

Plot K supplies another instance of a good yield following the application of phosphate to land comparatively low in humus. In the season 1930-31 on Plot J, only 6.10 bags per acre were reaped in spite of the addition of phosphates, so that the yield of 16.50 bags per acre obtained this season

after similar fertiliser treatment must, it would seem, be ascribed to the favourable seasonal factor rather than to the practice.

These rotation experiments all support each other in showing that with the exception of very favourable seasons the yields following applications of phosphate to soils lacking humus are almost invariably disappointing. As favourable seasons are fewer than unfavourable ones, the maintenance of an adequate supply of humus in the soil should be regarded as a matter of first importance. The experiments have also proved beyond doubt that a balanced rotational cropping system in which provision is made for a plentiful supply of humus is the best safeguard against that changeable and uncontrollable factor in crop production—the weather. When these conditions are fulfilled and the necessary amounts of phosphate are supplied, the fertility of the land can be maintained at a high level and heavy crops secured every season, excepting, perhaps, only those during which the climatic conditions are extremely unfavourable.

Fertiliser and Green Manure Trials.—This experiment was commenced in 1928-29 to determine whether it is more profitable to apply fertiliser to a green manure crop which is to be followed by maize, or to apply the fertiliser direct to the maize crop after ploughing under an unfertilised green manure crop.

The plots on which these experiments are carried out had previously been used for fertiliser trials with maize. Some were of average fertility after having received moderate dressings of fertiliser, but the productive capacity of others had been much reduced by constant cropping without the addition of manure of any kind. Thus the two methods of applying fertiliser have been tried out on land of moderate fertility as well as on land of low fertility.

In the tabulation below, the four plots which gave the lowest yields during the season preceding the commencement of these trials are grouped separately from the remaining four higher yielding plots in each class, in order that comparison of the effects of treatment may be facilitated.

Yields of Maize in Bags per Acre.

	Fertiliser applied to green manure crop.			Fertiliser applied direct to maize (after green manure).		
	Season 1927-28 before trials began.	Total two seasons: 1929-31.	Season 1931-32.	Season 1927-28 before trials began.	Total two seasons: 1929-31.	Season 1931-32.
	0.52	22.16	9.16	1.04	24.28	10.72
All plots of	2.08	31.04	12.88	4.08	23.64	11.96
low fertility	4.20	29.76	11.68	4.16	32.92	14.48
	4.32	26.00	12.56	5.32	29.60	13.44
Totals	11.12	108.96	46.28	14.60	110.44	50.60
Averages	2.78	27.24	11.57	3.65	27.61	12.65
		21.68	8.79		20.31	9.00
	4.72	26.04	10.60	5.84	30.56	12.16
All plots of	7.32	29.40	12.40	6.60	28.84	13.40
moderate fertility	7.64	29.84	11.24	6.72	28.96	12.04
	8.28	35.04	14.32	9.36	31.04	13.04
Totals	27.96	120.32	48.56	28.52	119.40	50.64
Averages	6.99	30.08	12.14	7.13	29.85	12.66
		16.10	5.15		15.59	5.53

The results this season support those obtained in the two previous ones in showing that no advantage is to be gained by fertilising the green manure crop, excepting when the fertility of the land has been reduced to a very low level before steps are taken to restore its cropping capacity. As a general rule it will prove more economical to apply the fertiliser direct to the maize crop, following the ploughing under of the green manure crop.

Comparison of the yields following the application of bone and superphosphate with those of the plots on which raw rock phosphate was used corroborate previous seasons' results in showing that both kinds of fertiliser were equally efficacious.

The Relative Value of (a) **Superphosphate and** (b) **Raw Rock Phosphate for Maize Production.**—These trials were commenced in season 1929-30, at which time there was considerable difference of opinion as a result of conflicting evidence regarding the value of raw rock phosphate on certain soils as a fertiliser for maize.

The "raw rock phosphate" referred to is quarried in Northern Africa and ground to a very fine powder, in which

state it is applied to the land without further treatment. It contains a total of 33.5 per cent. of phosphoric acid, 12 per cent. of which is soluble in a 2 per cent. solution of citric acid. The superphosphate used in these trials contains a total of 19.5 per cent. of phosphoric oxide, of which 19 per cent. is water soluble. Both fertilisers were applied at the rate of 200 lbs. per acre. Two separate experiments were laid down. In the first the rock phosphate was applied to the green manure crop, and the superphosphate was applied in the following season direct to the maize. In the second experiment, both fertilisers, and a third consisting of equal proportions of each were applied to the green manure crop.

(*a*) *Raw rock phosphate applied at the time the green manure crop was sown, versus superphosphate applied to the maize following the green manure*:—

The insolubility of the phosphate in the untreated rock might be expected to make it unavailable for the immediate use of plants, and for this reason it was deemed advisable to apply it to the land in the season before the maize was to be planted to allow sufficient time for agencies in the soil to convert it into available forms of phosphate. On the other hand, because the superphosphate supplies plant food which is immediately available, its application direct to the maize crop appeared to be the most economical method. Both of the fertiliser dressings were replicated eight times.

The following table gives the yields in lbs. per plot of 1-32 of an acre, repeated during the two seasons 1930-32:—

Yields of Maize in lbs. per Plot of 1-32 of an Acre.

Superphosphate.		Raw Rock Phosphate.	
1930-31	1931-32	1930-31	1931-32
110	121	114	103
100	120	85	119
101	123	98	125
89	167	95	132
94	97	119	157
96	125	104	133
110	138	101	127
107	132	92	118
807	1,023	808	1,014

The remarkable uniformity of these yields shows that under the conditions pertaining in this experiment the fertilisers were equally efficacious.

(b) *The relative effect on the yield of maize of (a) Raw Rock Phosphate, (b) Superphosphate, (c) Raw Rock Phosphate mixed in equal proportions*:—

In this series the fertilisers were all applied immediately before the green manure crop was planted. The various dressings were replicated eight times, and all were used at the rate of 200 lbs. per acre.

The resulting yields of maize are shown in the following tabulation in lbs. per plot of 1-24 of an acre:—

Yields of Maize in lbs. per Plot of 1-24 of an Acre.

	Superphosphate.		Super and Raw Rock Phosphate.		Raw Rock Phosphate.		
	1930-1	1931-2	1930-1	1931-2	1930-1	1931-2	
	93	118	124	123	130	141	
	106	107	110	82	143	143	
	150	143	154	150	163	143	
	118	123	143	149	154	151	
	133	110	152	144	170	150	
	158	127	177	169	133	129	
	154	150	127	121	153	150	
	144	148	155	165	184	189	
Totals of 8 plots ...	1,056	1,026	1,142	1,103	1,230	1,196	
Totals 2 seasons ...	2,082		2,245		2,426		Mean 2,251 S.E. 90
Bags per acre ...	31.23		33.67		36.39		Mean 33.77 S.E. 1.35

In this trial it is seen that the yield of maize over two seasons was five bags per acre more from the land which received rock phosphate than from that which received superphosphate, and that where the mixture was used the yield was almost identical with the mean yield of all the fertilised plots. In this experiment, therefore, somewhat higher yields have been obtained from the land on which the rock phosphate was used, and the question arises as to whether this was due to the greater efficacy of that form of phosphate or whether a part of the superphosphate may not have been rendered unavailable to the plants because of its having

formed insoluble compounds with other soil constituents. In the light of other experiments made with these fertilisers it appears that part of the superphosphate may have been lost in this way, and this experiment seems to show that it is not advisable to apply superphosphate to soils of the type found at this station a whole season before the cash crop is to be planted.

Method of Application of Fertiliser Trials.—These investigations were undertaken at the request of the Maize Association with the object of ascertaining whether the manner in which fertiliser is applied to the land is likely to affect the yield of the maize crop. Fertiliser is applied in four different ways, namely:—

(1) Broadcast shortly before planting time and harrowed in.
(2) Broadcast during winter and ploughed in.
(3) In holes in check rows shortly before the seed is planted.
(4) In drills at the time of sowing the seed.

Previous trials have indicated that in the first season after the application of fertiliser the various methods were equally effective, with the exception of method No. 1, in which the fertiliser is broadcast shortly before the seed is planted and harrowed in, to incorporate it with the surface soil. That this method should prove less efficacious than the others is unfortunate, because under general farm conditions it is the least expensive and most convenient method of applying the fertiliser. Other experiments cited indicate that when applied phosphates are not absorbed during the first season, they may be utilised by a later crop, in which case when regular application of fertiliser is practised, the temporary loss of a small proportion may not prove serious.

To investigate this aspect of the problem it was decided to re-arrange the plan and in future to practise each method of applying fertiliser in its own particular group of plots over a period of years, when, if after the first year or two the yield of the "harrowed in" plots equals those of the other methods, this method of applying the fertiliser will have been shown to be the most economical, in spite of the temporary loss of a bag or two of maize in the first season.

In the new trials each method of applying the fertiliser is replicated five times, and superphosphate is used at the rate of 150 lbs. per acre over the whole series of plots.

The following table records the yields of maize in lbs. per 1-20 of an acre plot, reaped during the season under review:—

METHOD OF APPLYING FERTILISER.

Lbs. per Plot of 1-20 of an Acre.

Harrowed in.	Ploughed in.	Holes.	Drills.
176	209	189	199
170	209	181	171
166	210	161	209
137	183	188	166
174	175	183	158
823	986	902	903

These results support those of previous trials in showing that where the fertiliser was harrowed in, the yield was less than where the other methods were employed. In this case there is a difference of two bags per acre in favour of the methods by which the fertiliser is placed fairly deeply in the soil.

The Relative Value of Sunn Hemp and Sunflower for Green Manure.—For a number of seasons Sunn hemp has been the most popular legume for use as a green manure in this Colony, but scarcity and high cost of seed has limited its use, and a number of farmers have been obliged to employ other crops instead. Of these the sunflower appears to possess considerable merit. Trials were commenced in 1928-29 to test the relative value of the two crops when used as green manures in preparation for maize. Duplicate plots were sown to Sunn hemp and sunflower, and plots on which equal weights of seed of both crops were sown together were included.

The difference between the yields obtained in these trials was so small that both crops appeared to be equally valuable for the purpose.

A new series of trials was commenced in the season 1930-31 in which the crops were sown separately, and also

mixed in equal proportions by weight of seed. Each treatment was replicated nine times, and all the plots were sown at the rate of 45 lbs. of seed per acre. Very dense stands were thus secured, and the crops were ploughed under between 20th February and 24th February, 1931, at which time both were beginning to form their first seed. The whole area was planted with maize during the season under review, with results as shown in the following tabulation, in which the yield of each 1-27 of an acre plot is given in lbs.

SUNN HEMP VERSUS SUNFLOWER FOR GREEN MANURE.

Yields of Maize in lbs. per 1-27 of an Acre.

	After Sunn hemp ploughed under.	Sunflower ploughed under.	After two crops mixed ploughed under.	
	181	160	152	
	183	138	162	
	148	155	163	
	177	151	171	
	153	157	157	
	164	135	170	
	202	166	174	
	159	156	149	
	110	120	111	
Totals 9 plots	1,477	1,338	1,409	S.E. 36.67
Yields in bags per acre ...	22.16	20.07	21.14	S.E. .55

The results of these trials indicate a decidedly heavier yield from the plots on which the Sunn hemp was ploughed under than from the sunflower plots, and a proportionately smaller increase in favour of the mixed crops. Although it is not possible to draw definite conclusions from a single season's results, it appears that under general conditions somewhat heavier crops may be expected to result from the use of Sunn hemp. In field practice it may be found more economical to mix the two crops. When this is done there may not only be a slight saving on the cost of seeding, but there is a better chance of one crop escaping in the event of the other being attacked by disease or insects pest.

Wide Spacing Between the Rows of Maize Versus Normal Spacing.—At the time these experiments were commenced a number of farmers believed that it would be more economical to plant maize in widely spaced rows, than to practise the usual method, because of the saving of labour which would be effected by reason of there being fewer rows to plant and hoe. It was contended that close planting in the rows would balance as wide a distance as nine feet between the rows, and that the labour saved by the acceleration of operations connected with planting and subsequent cultivations to destroy weeds would more than compensate for any small reduction of the yield which might result. Further, at the last cultivation a catch crop of haricot beans, or a hay crop, could be planted between the wide rows to make use of vacant land not utilised by the maize crop.

Trials were commenced in season 1930-31 and the plan included five different spacings, namely, the standard spacing of 3 feet by 18 inches, and 6 feet by 9 inches; 9 feet by 6 inches; 9 feet by 9 inches; 9 feet by 9 inches with a hay crop sown between the rows at the last cultivation.

The following tabulation shows the yields obtained during the two seasons 1930-32, with duplicate trials during the season under review:—

WIDE SPACING BETWEEN ROWS OF MAIZE.

Yields in Bags per Acre.

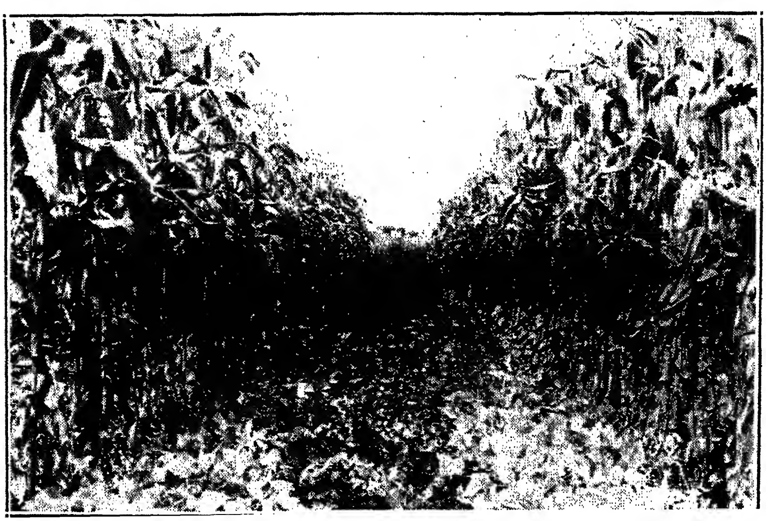
Distance of planting.	No. of plants per acre.	Season 1930-31.	Season 1931-32: Series 1.	Season 1931-32: Series 2.	Average 2 seasons (10 plots).
3 ft. x 18 ins.	9,680	14.79	24.53	22.50	20.61
6 ft. x 9 ins.	9,680	12.88	24.35	23.75	20.33
9 ft. x 6 ins.	9,680	11.24	21.95	18.53	17.24
9 ft. x 9 ins.	6,453	11.28	19.45	17.96	16.23
9 ft. x 9 ins. plus beans		10.67	18.56	17.25	15.49

It will be noticed that the two spacings 6 feet by 9 inches and 9 feet by 6 inches allow the stand to contain the same number of plants per acre as the standard spacing.

The results show that in the season 1930-31 there was a reduction in the yield of 14 per cent. and 24 per cent. for

Fig. 1.
MAIZE IN WIDE-SPACING TRIALS.
Right : Rows 3 feet apart.
Left : Rows 9 feet apart.
Owing to crowding in the widely spaced rows, the plants had a tendency to lean outwards. In consequence they were more liable to be blown over during stormy weather than those which were normally spaced.

Fig. 2.
Rows 9 feet apart on right and 6 feet apart on left.



the 6 feet by 9 inches and 9 feet by 6 inches spacings respectively, but in the more favourable season 1931-32 the yield from the rows which were 6 feet apart was about equal to that of the normal spacing, while the 9 feet by 6 inches spacing returned only 14 per cent. less. The 9 feet by 9 inches spacing appears to be too thin to allow of the heaviest yields being obtained, and although the hay crop was not planted between the rows of maize until the latter part of January, it appears to have caused a further reduction in the yield of about three-quarters of a bag per acre. The yield of hay obtained from a mixture of cow peas and soya beans was half a ton per acre. It will be seen that the average yield of maize from the 9 feet by 9 inches maize plus bean combination plots is 25 per cent. less than where the maize was grown in the usual manner. Although in the cultivation of the maize some economy would be effected by planting in rows which are far apart, the collection of the hay crop from between the rows would prove more laborious than the harvesting of a similar crop from open land. It is doubtful, therefore, whether there is anything to be gained by spacing the rows as far as nine feet apart, except perhaps for the farmer whose lands consist largely of clay soil, the cultivation of which is difficult when wet weather prevails.

On the whole, however, the practice of excessive wide spacing does not seem to have much to recommend it.

Ground-Nut Fertiliser Trials.—In previous reports the details of three separate series of fertiliser trials have been recorded. Two of these indicated slight response only to fertiliser treatment, but in the third series a profitable return was obtained from phosphatic fertiliser applied to soil of somewhat low fertility.

A fourth series was commenced in the season 1929-30 in which the fertiliser dressings were the same as those applied in series 3, which included basic slag at the request of the Enterprise Farmers' Association.

The treatments were as follows:—

1. Basic slag, 200 lbs. per acre.
2. Superphosphate (19 per cent. P2 05), 200 lbs. per acre.
3. Superphosphate, 200 lbs., plus muriate of potash, 50 lbs. per acre.

Each treatment was applied to eight plots of 1/32 acre in extent, arranged in the form of two adjoining 4 x 4 Latin squares, the rows of which were further sub-divided to accommodate the two varieties Valencia and Virginia Bunch. The fertiliser was broadcasted on the surface and harrowed in shortly before the ground nuts were planted.

In the tabulation below the yields of the sub-plots sown to each variety are shown. Those for the season 1929-30 are found in the first column, while those in the second column are for the season 1931-32.

VALENCIA GROUND NUTS.

Yields in lbs. per Plot of 1-64 acre.

	Fertiliser No. 1.		Fertiliser No. 2.		Fertiliser No. 3.		No Fertiliser	
	20	15½	20	11¼	21½	11¼	25½	12¼
	26	10½	27	14¾	23	10	21	8¾
	26	7	26	6	33	10¼	25	10¼
	28	8¼	22	5½	23	5¾	27	5¼
	34	8¾	36	16½	36	10¾	33	6
	36	16	41	8½	34	9	36	9¼
	35	8	38	13¼	34	13½	38½	9¾
	37½	14½	34	12¼	34½	12¾	31½	18½
Total, 8 Plots:	242½	88½	244	88	239	83¼	237½	80
Bags per acre:	25.9	9.5	26.1	9.4	25.6	8.9	25.4	8.6

VIRGINIA BUNCH GROUND NUTS.

Yields in lbs. per Plot of 1-64 acre.

	Fertiliser No. 1.		Fertiliser No. 2.		Fertiliser No. 3.		No Fertiliser	
	24	19	26	17	27	19¼	26	22¼
	31	21½	21	22½	26	20	30	18
	30	19	28	18¾	19	20½	24	20
	27	18½	31	20¼	32	19	30	21¼
	26	23	29	21	29	21	33	19
	35	25	30	21½	33	18¼	37½	21
	40	20	45	25¼	29	27	36½	24¼
	30	26½	25	21½	23	23	26½	24½
Total, 8 Plots:	243	172½	235	167¾	218	168	243½	170¼
Bags per acre:	26.0	18.5	25.1	17.9	23.3	18.0	26.1	18.2

These results fail to show any response to the fertiliser dressings either in the year of its application or in the following season. The chief point of interest is that during the second season the yields of the Virginia Bunch variety were much higher than those of the Valencia. This is chiefly due to the latter variety being less resistant to the Cercospora leaf spot disease, and the experiment serves to show that owing to the susceptibility of this ground nut to leaf diseases it is bad practice to plant on the same land for two consecutive seasons.

On the whole in all these experiments ground nuts have shown little response to fertiliser treatment and only on land of low fertility can it be claimed that the fertiliser has produced economic returns.

In view of the beneficial effects which follow the use of phosphates on many other crops, it is surprising that such small response has been obtained in these experiments, and the question arises as to whether the method of applying the fertiliser may not have some bearing on the results. It is proposed to investigate this point in the future by applying the fertiliser in the seed drills versus broadcasting it on the surface and harrowing it into the soil.

Ground Nut Varieties.—Two new varieties, which are representative of the nuts exported from Bombay and Java respectively, were received from the High Commissioner for Southern Rhodesia and planted during the season under review, with check plots of the varieties Valencia and Jumbo. The Bombay variety is of the runner type, while that from Java belongs to the "bunch" class. This latter variety has small pods which usually contain only two kernels with skins of a light pink colour. The plots were arranged in the form of a 4 x 4 Latin square and the yields in bags per acre were as follows:—Jumbo, 19.5; Valencia, 18; Bombay, 17.3; Java, 9.7. It is seen that the new introductions were not as productive as the established kinds. The fact that they are not yet acclimatised may account for this in part at least. The new variety called Masumbika was sown at another place with Jumbo as control. In this case "Jumbo" yielded 30.4 bags per acre and the "Masumbika" 26.2 bags per acre.

The yield of the Jumbo variety exceeds that of the Masumbika by 16 per cent. this season as against 18 per cent. last season.

Soya Bean Variety Trials.—Several varieties were excluded from these trials this season owing to their inferior yields over a period of three years, but a large number of selections of promising strains which have originated on this Station were included. The main object of these trials is to obtain strains which, owing to their production of large quantities of vegetative growth, will be suitable for use as hay silage or green manure.

Below the mean yields of quadruplicate plots are tabulated:—

SOYA BEAN VARIETIES.

Yields in lbs. per acre. Season 1931-32.

	Otootan	Herman	Biloxi	Chiquita	Chinese White	Southern
Hay	3,970	2,360	2,824	1,920	1,692	847
Seed	1,204	1,166	674	767	800	380

	Soyolk	Tokio	Mammoth Yellow	Sel. No. 6	Sel. No. 10	Nyasaland Black
Hay	1,576	1,720	1,640	3,840	3,520	3,160
Seed	596	940	728	1,280	1,254	967

The "Soyolk" variety was received for trial through the courtesy of the High Commissioner for Southern Rhodesia, who stated that it was the kind used in the manufacture of a number of foodstuffs on sale in the United Kingdom. Only the yellow seeded varieties are suitable for this purpose, but none of these produce seed in sufficient quantity in Rhodesia to justify their cultivation under field conditions. The Herman is the only yellow-seeded variety whose seed production approaches that of the black-seeded kinds, but it is doubtful whether the five or six bags per acre which it produces could be grown at a profit, even though the stalks remaining after thrashing out the seed were used for feeding to live stock. The black-seeded variety Otootan and selection No. 6 are the

only kinds whose cultivation can be recommended, and these primarily for their fodder. Selection No. 10 matures a few days earlier than Otootan, and the seed crop ripens somewhat more uniformly than that of the other varieties. Because of this there is less likelihood of serious loss through the seed shattering during harvesting operations. It is doubtful, however, whether this advantage will balance the somewhat lower yield of fodder which it produces in comparison with that of the Otootan.

Sunn hemp.—As is known, this crop has proved most valuable for use as a green manure, and although it has been sown on increasingly large acreages during recent years, its employment has been curtailed to some extent on account of the small seed yield and consequently high prire of seed. Investigations have therefore been undertaken during the past two years with a view to increasing the yield of seed, since this would enable farmers to use it even more freely, as well as to reduce the general cost of green manuring. The successful solution of this question, therefore, has a direct bearing on the cost of maize production. In the report for last season it was mentioned that some of the plots under trial had behaved in a very abnormal manner in that, although the whole crop grew luxuriantly and appeared normally healthy until the flowering stage was reached, it was observed that a large proportion of the flower buds fell to the ground unopened, and that the majority of those which opened were sterile, the yield of seed amounting to a few pounds per acre only. In order to determine whether this abnormal behaviour was due to constituents in the soil Sunn hemp was again sown on this area during the season under review, and a normal yield resulted. It is thought, therefore, that the occurrence of droughty conditions before and during the flowering period and after the plants had made luxuriant growth were mainly responsible for the unfruitfulness of the crop in this instance.

Heavy-bearing Strains.—Another means which is being employed to overcome the low yield problem is the establishment of individual strains from heavy-bearing plants. Three years ago several strains were segregated for this purpose, and the results indicate that some of these are capable of yielding 30 per cent. more seed than the common variety.

During the season under review the strains under trial were increased to 130. This number includes some of an Indian variety, the seed of which was received through the courtesy of Mr. A. S. Laurie, of Somerset Farm, Concession. During the two seasons this variety has been under trial it has produced a somewhat larger weight of seed per acre than the common variety. It appears also to be a more consistent yielder, and further, owing to the seed being only about half the size of that of the common variety, a given quantity will sow twice as much land as a similar quantity of the latter. It is therefore much more economical to use, and should lessen the cost of seed for green manure very considerably. This variety has been named "Somerset" after Mr. Laurie's farm, and small quantities of its seed have been issued to a few farmers for more extended trial.

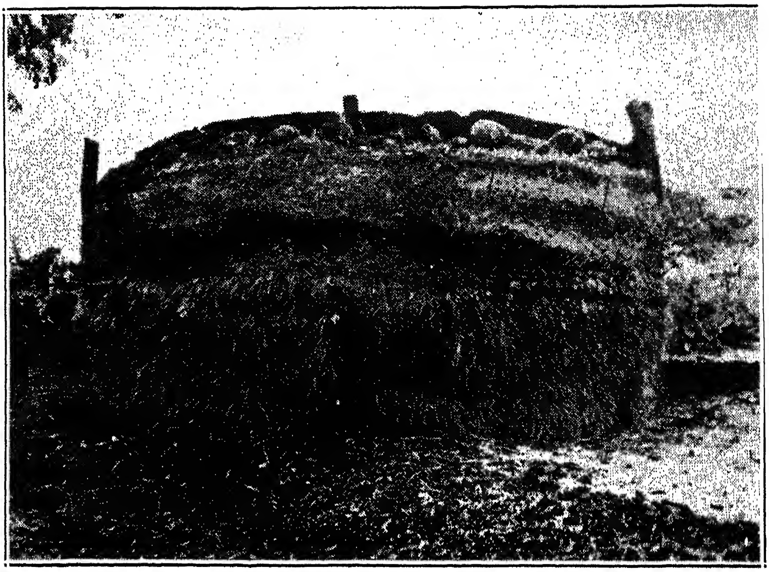
Summer Oats.—With the object of obtaining strains which are better suited for summer cultivation than those which have already been distributed, the work of testing out further selections and hybrids has been continued. By hybridising the hull-less variety with our most rust-resistant strain of the Kherson variety, a number of strains have been established which are at present more rust-resistant than either of their parents. During the season under review the parent strain of hull-less oats was badly affected by rust, which reduced the grain yield very considerably.

S.E.S. Oats.—These oats have steadily gained favour in Mashonaland since their distribution to a very limited number of farmers three years ago. They have proved very resistant to rust attack, and on fertile soils have yielded very heavy crops of fodder and grain. A number of strains of this variety have been segregated and are now under trial with a view to the isolation of the best, which will then be bulked up and distributed.

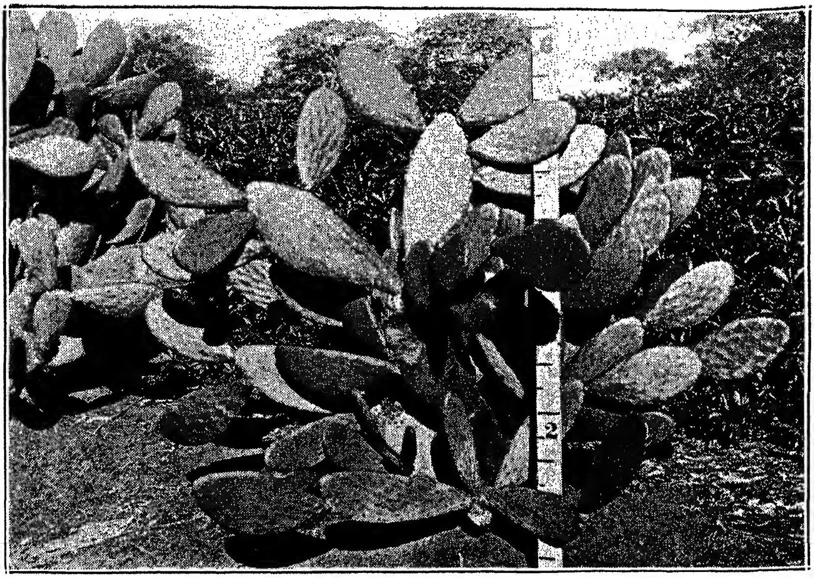
Safflower.—This oil seed, which is a native of India, is being grown widely to-day in the United States of America, because for many purposes its oil can be used as a substitute for that of linseed. After the oil is expressed the residue of the seed can be used as cattle feed. The present market is limited, and expansion is dependent upon the extent to which paint and varnish manufacturers adopt this oil in place of linseed oil.

Oat Selection : each sheaf is the product of a separate plot.

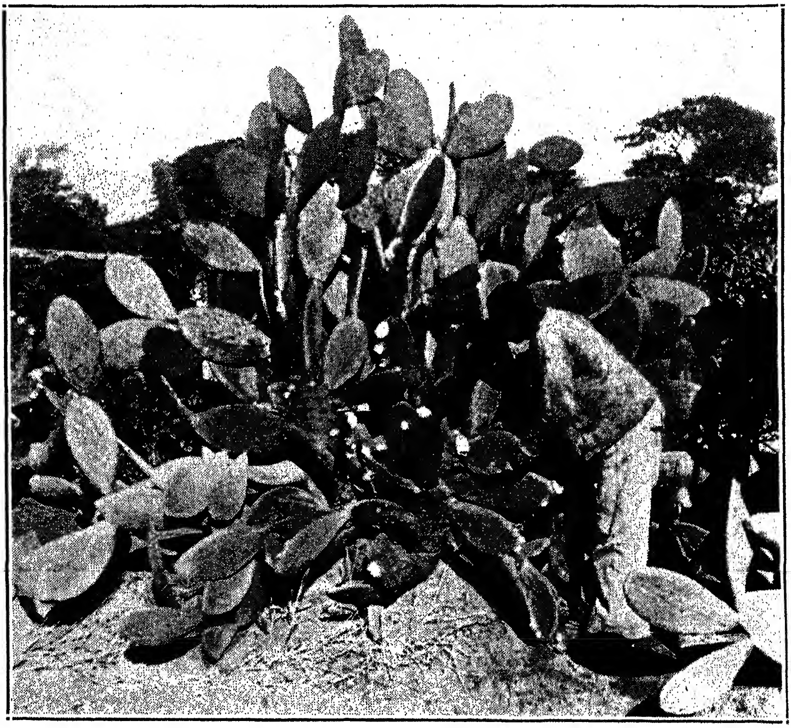
Safflower : Distance planting trials. The crop failed to produce seed and hence it cannot be recommended for general cultivation.



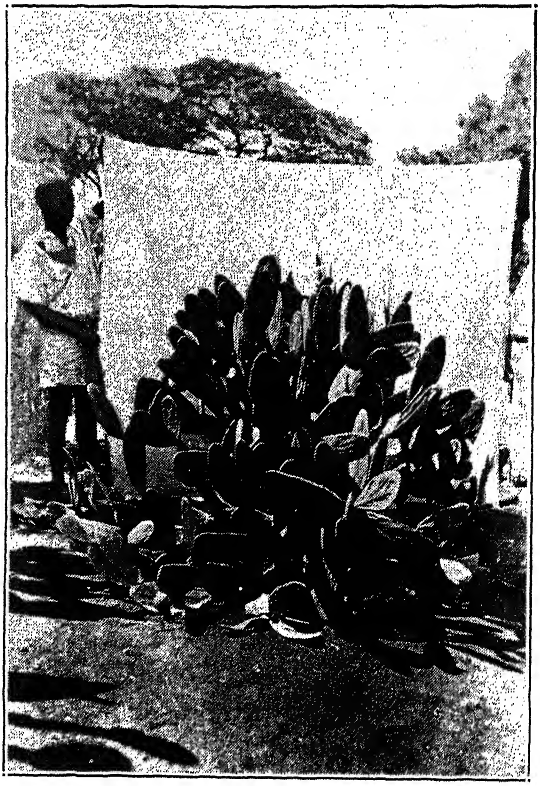
Silage stack showing methods adopted for retaining the weighting material.



Showing growth of new blades on stumps from which growth was removed one year previously. About 100 new blades were produced in one season.



Spineless Cactus. Algerian variety grown at the Agricultural Experiment



Peacocke's Cactus. The blades of this variety are comparatively small and thin, but they are produced more abundantly than those of the other kinds, and are practically free of spines and spicules. It is non-fruiting, and is therefore not likely to be a source from which noxious spiny forms can originate.

Trials were undertaken at the request of a local firm of merchants, who reported that their London agents were prepared to purchase quantities of the seed. It was found to be a very convenient crop to handle, as it could be sown with a grain drill and harvested with machinery. Although the matured crop was left in the field for upwards of a month, none of the seed shattered. It appeared very resistant to drought, and was not sought after by birds. In the preliminary trials in 1930-31 it yielded 1,044 lbs. of seed per acre. During the season under review distance planting and date planting trials were carried out. The crop developed satisfactorily at first, but shortly before the first flowers opened it was attacked by a fungus disease belonging to the Alternaria group, with such virulence that very little seed matured, and on this account its cultivation on a commercial scale cannot be recommended.

Spineless Cactus.—In those areas which are favoured with an average annual rainfall of 25 inches or over, such crops as canna, sweet potato, pumpkin and cattle melon can usually be relied on for succulent winter feed, but in districts in which the rainfall is frequently less than these crops require, farmers would find the spineless cactus a very useful alternative, even though its chief place might be as a reserve in the event of the partial failure of the other crops. The term "spineless" is actually a misnomer, since several of the improved varieties are not entirely without spines, but those which are present are smaller, very much softer and fewer in number than the spines which are found in the wild species. Spineless cactus is of particular value on account of its tolerance to droughty conditions and the large amount of moisture which it contains. It has been found that by feeding cactus, together with moderate quantities of maize and hay, it is possible to maintain live stock in good condition for long periods without water from any other source. A few blades of each of the varieties: Hardybred, Guayaquil, Muscatel, Corfu, Monterey and Opuntia fusicaulis were introduced from the Grootfontein School of Agriculture in 1929. From these sufficient blades have been obtained to plant small test plots during the season under review, with the object of ascertaining the relative merits of the various kinds.

Grass Silage in Stack.—During January an experimental stack of grass silage was made in order to determine whether this method of making silage could be recommended for general practice. A shallow circular pit 14 feet in diameter and 4½ feet deep was first made, as by this means the labour of stacking can be reduced somewhat, and further, the excavated earth can be used to weight the material when the stack is completed. On 25th January grass cutting commenced, and the material was brought to the silo as soon as possible after cutting. Some doubt had been expressed as to whether it was possible to cut grass during actual rainy weather by means of the machines in general use, and it was found that on areas from which the previous season's growth had been burnt off during the winter, no difficulty was experienced in cutting the grass even while rain was falling. However, where there remained a moderate amount of the previous season's growth, it clogged the knives of the machine and prevented the work from being carried on during wet weather, but even if it could have been cut, the material would not have been very suitable for conversion into silage.

Each day's work added about 4 feet of fresh material to the stack, but after two or three days this amount became compressed into a layer about a foot thick by the weight of the added material combined with the effect of fermentation. During the process of building, the stack was well tramped. Not only was the material consolidated by this means, but any unevenness of packing was revealed and it could then be rectified.

Stacking continued for ten days, during which rain fell at frequent intervals. During a part of this time a tarpaulin was hung on the windward side, since it was found that even a slight wind retarded fermentation on the windward side, and resulted in uneven settling, which caused the stack to lean over toward the sheltered side so much as to necessitate supporting it artificially.

The stack had reached a height of 9 feet above ground level, when it was decided to discontinue adding further silage material, and to proceed with closing it down by applying the necessary weighting material to ensure the preservation of the silage.

It is essential that weight should be applied as near to the edge of the stack as possible, as well as over the remainder, and to facilitate this a wire netting frame was erected around the circumference of the stack, this being secured to a strand of fencing wire previously strained around the stack at a point a few inches from the top. The netting wire encircled the stack two or three times in order to provide adequate strength, and to allow grass to be placed between the fences to prevent the earth used for covering the stack from silting through. Various other materials were used for this purpose, including stones, billets of wood, short lengths of sheet iron, etc., but the grass was quite satisfactory, and seeing that it may be easily obtained, it would be found economical to use in most cases. Stones were placed all round the stack at the foot of the wire netting, and these were found to have served a useful purpose by preventing the earth from silting through the space which eventually appeared between the silage and the base of the wire netting, caused through the decomposition and consequent shrinkage of the outer layer of the silage. The whole of the stack was covered to a depth of 2 feet with stones and earth.

During the period which intervened between the making of the silage and the opening of the stack on 15th August, the decomposition of the material around the outside of the stack was continuous, ultimately resulting in shrinkage to such an extent as to dislodge the wire netting frame, and allow part of the covering of earth and stones to fall off the stack, which in turn resulted in the still more rapid decay of the silage. Upon opening up the stack it was found that the material was sweet scented and dark brown in colour, and that it was readily eaten by cattle, though not with the same relish as maize silage. The part of the stack above ground level was enclosed in a belt of mildewed material about 12 inches thick, which was quite unfit for cattle food, but the whole of the core was in excellent condition. It is noteworthy that the foliage and stalks of the common shrub known as Eriosema or Vaalbosch, which are not eaten by cattle in the green state, are rendered palatable by conversion into silage.

The experiment indicates that it is possible to make grass silage of good quality in stacks, but owing to the amount of waste material which develops around the sides and at the top of the stacks it is thought that the pit method of ensiling would prove more economical. A combination of pit and stack could be employed with advantage by farmers who find they are unable to sink deep pits. In this system earth could be packed against that part of the silage material stacked above ground level to prevent the entrance of air and consequent spoilage through the growth of mildews.

Temperatures.—The temperature of the material was recorded daily for the first month, and at frequent intervals after that. On the third day after the commencement of the operations 95° F. was recorded, two days later 140° F. was reached; ten degrees were added to this in five days, and six days after this the highest tempearture recorded was reached, viz., 163° F. This high temperature was maintained for six days, after which it slowly declined. At the end of February 160° F. was recorded, and a month later the temperature stood at 155° F. It is seen, therefore, that high temperatures were maintained for a long period.

SOUTHERN RHODESIA ANNUAL MILKING COMPETITION.

Issued by the Dairy Branch.

The results of the Annual Milking Competition held last year, which are published hereunder, are of considerable interest inasmuch as they demonstrate that it is quite possible under our, at times, somewhat unfavourable conditions, to maintain dairy herds of comparatively high production. This competition, which was the first of its kind to be held in this Colony, commenced on the 1st January and ended on the 31st December, 1932.

Entries were restricted to farmers who made butter or cheese or who supplied cream to a creamery or milk to a cheese factory. Dairymen who supplied fresh milk for town consumption were excluded from the competition, as it was felt that the high prices which these farmers received for their produce would enable them to feed their cows better than those dairymen who were supplying cream to a creamery, etc., and the latter would thus be placed at a disadvantage.

The competition was conducted subject to the rules of the Government Milk Recording Scheme, and possessed one or two unusual features which might perhaps be mentioned.

The first of these is the fact that every cow in the herd entered for the competition had to be tested and recorded; this has had the effect of lowering the result inasmuch as quite a number of cows had to be entered for the competition which would otherwise not have been included.

Secondly, the competition commenced and closed on certain stipulated dates, which meant that all cows in milk during that period, whether for one day or three hundred days, had to be taken into account and this, in turn, has also had a depressing effect on the final results.

The latter were calculated by dividing the total milk and butterfat production of each herd for the year by the number of cows which contributed to the total. The results, there-

fore, satisfactory as they undoubtedly are, should not however, be compared with those of other milking competitions in which competitors are allowed to enter specially selected teams of fifteen or twenty cows, etc. If the results of this competition had been based on the performances of the best fifteen or twenty cows in each herd, then the average milk and butterfat production would have been very much higher than the figures actually attained.

Notwithstanding the fact therefore that the results have been calculated on a somewhat unsatisfactory basis and do not perhaps represent actual herd averages, the competition has been well supported and has been an undoubted success.

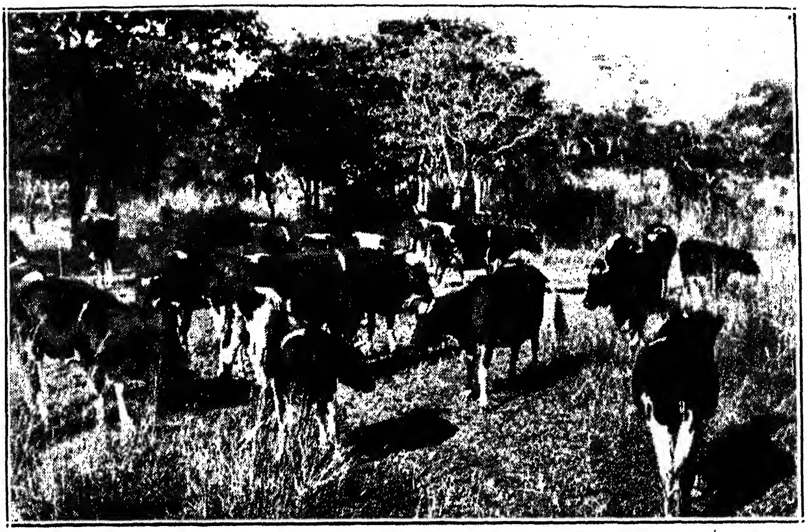
Silver trophy donated by Mr. C. C. Kilburn, Dorset, England, for the herd with the highest average milk production.

It owes its inception to Mr. G. C. Kilburn, of Macheke, and Mr. R. le S. Fischer, of Headlands. It was through Mr. Kilburn that the idea first originated and the adoption of the scheme was made possible by the presentation by Mr. C. C. Kilburn, of Dorset, England, of a handsome silver trophy—the "Kilburn Cup"—which is to be presented yearly to the herd with the highest average milk production.

Mr. Fischer, another keen supporter of milk recording, in recognition of the value of such a competition to breeders and owners of dairy stock, was also good enough to donate a similar trophy—the "Fischer Cup"—which is to be awarded yearly to the herd with the highest average production of butterfat.

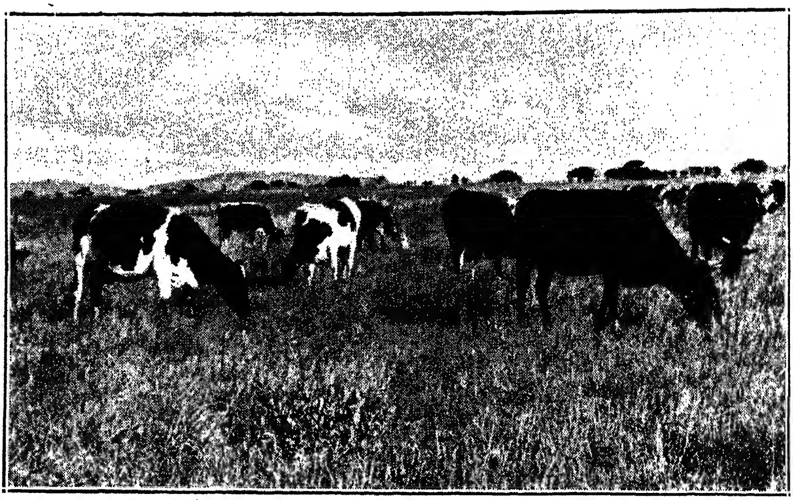
Grateful acknowledgement is made of the practical manner in which Messrs. Kilburn and Fischer have demonstrated their interest in milk recording in Southern Rhodesia.

Thanks are also due to Messrs. The Rhodesian Farmers' Co-Op. Industries, Ltd.; The Rhodesian Co-Op Creameries,



Mr. W. R. Blackwell's Friesland herd at Daisy Farm, Norton. Winner of both competitions.

Mr. G. C. Kilburn's Frieslands at Wensleydale, Macheke.



Mr. R. Fischer's herd at Headlands.

Ltd.; The Express Nut, Oil & Soap Works; The Central Cotton Ginneries and the Matabeleland Farmers Co-Op, for donations of valuable special prizes.

It is hoped that the 1933 competition which is being conducted on different lines, and particulars of which are obtainable from the District Dairy Officer, Bulawayo, will have similar support from the concerns who have made such valuable contributions this year.

In conclusion, the opportunity is taken of congratulating all prize winners, especially Mr. W. R. Blackwell, of Daisy Farm, Norton, on his success in securing first prize in both competitions.

The results are as follows:—

Competition "A"—To the herd showing the highest average milk production per cow:—

1st prize: (1) "Kilburn Cup"; (2) and one ton of Monkey Nut Cake (presented by Messrs. The Rhodesia Farmers' Co-Op Industries, Ltd., Salisbury). Winner: W. R. Blackwell, Daisy Farm, Norton: 17 cows yielding 7117.18 lbs. of milk per cow.

2nd prize: ½ ton Monkey Nut Cake (presented by Messrs. The Express Nut, Oil & Soap Works, Salisbury). Winner: G. C. Kilburn, Wensleydale Farm, Macheke: 35 cows yielding 4260.73 lbs. milk per cow.

3rd prize: —— Winner: R. le S. Fischer, Wakefield Farm, Headlands: 42 cows yielding 4230.45 lbs of milk per cow.

Competition "B"—To the herd showing the highest average production of butterfat per cow:—

1st prize: (1) "Fischer Cup"; (2) and one ton of Cotton Seed Cake (presented by Messrs. The Central Cotton Ginneries, Salisbury). Winner: W. R. Blackwell, Daisy Farm, Norton: 17 cows yielding 244.05 lbs. of butterfat per cow.

2nd prize: Two five-gallon cream cans (presented by Messrs. The Matabeleland Farmers' Co-Op. Industries, Ltd., Bulawayo). Winner: Ryk le S. Fischer, Wakefield Farm, Headlands: 42 cows yielding 164.430 lbs. butterfat per cow.

3rd prize: Two six-gallon cream containers with stirrers (presented by Messrs. The Rhodesia Co-Op. Creameries, Bulawayo). Winner: G. C. Kilburn, Wensleydale Farm, Macheke: 35 cows yielding 163.04 lbs. of butterfat per cow.

A LIST OF PLANT DISEASES OCCURRING IN SOUTHERN RHODESIA.

SUPPLEMENT 3.

(New Records for the Period June, 1932, to May, 1933.)

Compiled by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A., Government Plant Pathologist.

This third annual supplement to "A List of Plant Diseases Occurring in Southern Rhodesia" includes several records supplied by Mr. G. R. Bates, of the Citrus Estate, Mazoe. They are indicated by the symbol (*G. R. Bates*).

Acknowledgments are due to the Directors and staffs of the Imperial Mycological Institute and the Royal Botanic Gardens, Kew, to Dr. E. M. Doidge and to Prof. N. J. G. Smith for several determinations.

BAMBOO (*Bambusa* sp.).

Foot Rot *Helminthosporium sativum* Pamm., King and Bakke.

BANANA (*Musa sapientum* L.).

Ripe Rot *Glœosporium musarum* Cke & Mass.

BEANS.

French Bean (*Phaseolus vulgaris* L.).

Root Disease *Macrophomina phaseoli* (Maubl.) Ashby. (*R. bataticola* (Taub.) Butl. only.)

Lima Bean (*Phaseolus lunatus* L.).

Leaf Spot *Ascochyta pisi* Lib.

Mosaic. Virus.

Soya Bean (*Glycine soja* Sieb. & Zucc.).

Leaf & Stem Blight *Ascochyta pisi* Lib.

Berlinia globiflora Hutch. & Burtt Davy.
Mildew *Erysiphe polygoni* DC.

Brachystegia randii Bak.f.
Mildew *Erysiphe polygoni* DC.

BUDDLEIA (Cultivated).
Root Rot *Sclerotium rolfsii* Sacc.

CABBAGE (*Brassica oleracea* L.).
Black Rot *Bacterium campestre* (Pam.) E.F.Sm.

CITRUS.
GRAPEFRUIT (*Citrus grandis* Osbeck).
Stem-end Rot *Hypomyces ipomeae* (Hals.) Wollenwr. (*G. R. Bates*).
Stem-end Rot *Phomopsis citri* Fawc. (*G. R. Bates*). (=*Diaporthe citri* Wolf.)

ORANGE (*Citrus sinensis* Osbeck).
Branch Rot *Trametes cervina* (Schw.) Bres. (*G. R. Bates*).
Stem-end Rot *Hypomyces ipomeae* (Hals.) Wollenwr. (*G. R. Bates*).
Stem-end Rot *Phomopsis citri* Fawc. (*G. R. Bates*): (=*Diaporthe citri* Wolf).
Storage Rot *Aspergillus niger* van Tiegh. (*G. R. Bates*).

COWPEA (*Vigna catjang Wolfs*).
Rust *Uromyces appendiculatus* (Pers.) Link.

CYPRESS (*Cupressus* spp.).
Die-Back *Botryodiplodia theobromae* Pat.

Dolichos lupiniflorus N. E. Brown.
Mosaic. Virus.
Rust *Uromyces appendiculatus* (Pers.) Link.

Fimbristylis exilis Roem. & Sch.
Smut *Cintractia axicola* (Berk.) Cornu.

GRANADILLA (*Passiflora edulis* Sms.).
Anthracnose *Glomerella cingulata* (Stonem.) Sp. & von S.

GRASSES.

Cynodon transvaalensis Burtt Davy.

Brown Patch *Rhizoctonia solani* Kühn.

Leaf Blight *Helminthosporium* (*sativum* group).

Heteropogon contortus Roem. & Schl.

Smut *Sphacelotheca monilifera* (Ell. & Ev.) Clint.

Hyparrhenia sp.

Rust *Puccinia erythraeënsis* Pazschke.

Urochloa bulbodes Stapf.

Rust *Uromyces leptodermus* Syd.

HYDRANGEA (*Hydrangea* spp.).

Mildew *Oidium hortensiae* Foëx.

MAIZE (*Zea mays* L.).

Leaf Spot *Physoderma zeae-maydis* Shaw.

"Silk Cut." Unknown.

NASTURTIUM (*Tropœolium majus* L.).

Leaf Spot *Pleospora tropœoli* Halst.

PAW PAW (*Carica papaya* L.).

Stem Rot *Pythium ultimum* Trow.

PINE (*Pinus insignis* Dougl.).

Damping-off *Pythium ultimum* Trow.

Root Disease *Rhizoctonia lamellifera* Small.

POTATO (*Solanum tuberosum* L.).

Blackleg *Bacillus carotovorus* group.

SIDA (*Sida cordifolia* L.).

Leaf Curl. Apparently a Virus.

TEPHROSIA (*Tephrosia heckmanniana* Harms.).

Rust *Ravenelia tephrosiae* Kalchbr.

AMENDMENTS TO PREVIOUS LISTS.

TOBACCO (*Nicotiana tabacum* L.).

Alternaria Leaf Spot. For *A. tabacina* (Ell. & Ev.) Hori, read *A. longipes* (Ell. & Ev.) Tisd. & Wadk.

MISCELLANEOUS HOSTS.

Root Disease. For *Rhizoctonia bataticola* (Taub.) Butl. (strain A of Haigh), read *Rhizoctonia lamellifera* Small.

LOCUST INVASION, 1933.

SOUTHERN RHODESIA.

Monthly Report No. 5, April, 1933.

1. **Nomadacris septemfasciata.**—The great majority of the surviving swarms of this species have now attained maturity and flying swarms are traversing the Colony in various directions. In most districts a few belated hatchings were still in the hopper stage at the end of the month.

Large swarms are reported as having entered the Colony from the Mozambique Company's territory, and some have left the Colony in a westerly direction flying into Bechuanaland. The flights do not appear to be definitely of a migrationary character, but the general drift appears to be westerly to northerly. A few movements in other directions are reported. Practically the whole of the Colony except the extreme southern position is involved.

Newly matured fliers appear to keep to the same vicinity for about two weeks before making off. During this period they join up with other similar swarms.

2. **Locusta migratoria migratorioides.**—No specimen from swarms of this species has been received since 4th April, and it is uncertain whether any remain in the Colony. A few adults have been noted associated with swarms of the red species.

It is of interest that adults of this species confined in cages have assumed breeding coloration and have been observed mating. The ovaries also showed considerable development by the end of the month.

3. **Feeding.**—The newly matured swarms are reported as feeding voraciously.

4. **Parasites and Disease.**—Threadworms have been found in hoppers of the 4th, 5th and 6th stages and in adults in the Lomagundi district. It may be noted that this was the only district in which these worms were found in adults of the egg-laying generation in January.

5. **Destruction of Hoppers.**—The campaign has been prosecuted vigorously throughout the month, but is now drawing to a close. Returns to date indicate that well over 100,000 swarms, large, medium and small, have been destroyed by the Government operators and by farmers. Some of the swarms have been very large. It is estimated provisionally that the average amount of poison used per swarm destroyed is somewhere near 40 gallons.

A complete clean up of the swarms throughout the Colony has been an impossibility, but the destruction achieved must undoubtedly be reflected in the present position. Unfortunately, with heavily infested States on three sides of the Colony the position is still very grave and the outlook for next wet season is decidedly unfavourable.

6. **Damage to Crops.**—No serious losses of European crops have been reported during the month, but damage to native crops has occurred in various districts. The native crops over a considerable portion of the Colony have failed on account of drought, and in these areas locust damage has not materially affected the position. Most of the crops in the areas where the rainfall has been sufficient have been protected, but appreciable damage has been sustained in certain native reserves in this category.

The main maize crop is now sufficiently matured to be safe from damage from flying swarms, but the outlook for winter crops is far from reassuring.

N.B.—Half-monthly reports have now been discontinued, the last being No. 9.

RUPERT W. JACK,
Chief Entomologist.

FARMING CALENDAR.

June.

BEE-KEEPING.

At this season hives require to be painted; the woodwork, being exceedingly dry, is in good condition to receive it. Linseed oil (unboiled) is the best kind to mix with white lead, as it is more penetrating, acting as a better preservative than boiled oil. Bees will be able to take beneficial flights during warm days, so that dysentery need not be anticipated.

CITRUS FRUITS.

Cultivation of the grove is to be continued. Early ripening fruit must be harvested and marketed without delay. Mid-season varieties will be fit for packing early in the month. These should be shipped as early as possible, so as to extend the late variety export season as much as possible. Most late ripening varieties will require irrigating during the month.

A small amount of pruning should be done. If fumigation is to take place, remove the small branches that touch the ground, cut out all dead wood and water shoots.

CROPS.

Select seed from the very best of your own crops. It is always wise to keep more seed than you may need for planting. Do not shell and ride your maize to the railway unless it is fit for export or market. If in doubt regarding the moisture content of the maize, send a 2 lb. sample in an air-tight tin, such as a golden syrup tin, to the Agricultural Department and have it tested. Provide ample dunnage for your maize stacked at the railway or on the farm. Use maize cobs; husks are almost useless for this purpose. Sew your bags of maize according to the export regulations and stack them properly at the railway side, leaving plenty of room between the double rows. Select pumpkin and melon seed from the best specimens. Support your agricultural show and make it a success by preparing and entering as many exhibits as you can. No one is more to blame for a poor show than the farmers themselves. Make a list of the seed requirements for next season, and where purchases must be made, place the orders early.

In cleaning up the cotton fields care will have to be exercised in the supervision of the pickers. The cotton harvested at this period of the season generally comes from late bolls naturally matured and those prematurely opened by the cold weather and frost. The matured seed cotton should be kept entirely separate from the immature seed cotton. There will also be some dirty and stained cotton in this final picking. Arrangements for next season's seed requirements should receive consideration.

Veld fires must be anticipated, and if not already attended to, the mowing or burning of fire-guards, both boundary and internal, should be proceeded with.

DECIDUOUS FRUITS.

General pruning may be done this month if the leaves have fallen. This should be confined, as far as possible, to the thinning out of diseased, weak, broken and dead shoots. Tall trees may be reduced in height, and old and unprofitable trees headed back to induce the growth of new fruiting wood. Trees that shed their leaves late may be pruned

in July. The necessary preparations for planting trees should be completed during the month and planting commenced towards the end of the month. Cultivation should be continued.

ENTOMOLOGICAL.

Cabbage Family.—Plants of this family suffer from cabbage louse and Bagrada bug during June.

Onions.—Suffer from thrip. The transplants may be dipped as far as the roots in tobacco wash or paraffin emulsion to keep down the pest.

Fig.—The winter crop of fruit is liable to suffer from fig weevil. The infested fruit should be collected and destroyed. If this has been done regularly with the first crop, the second crop is not likely to suffer much.

FLOWER GARDEN.

Annuals for early spring flowering should be sown, preferably in paraffin tins cut lengthwise, in a place sheltered from the wind. Perennials, shrubs and ornamental tree seeds may also be sown. Fruit trees, shrubs and roses should be pruned and all dead wood removed. Sweet peas require constant attention.

VEGETABLE GARDEN.

All the available space in the garden should now be thoroughly trenched and manured, the soil being well worked and loosened. Vegetables planted out for winter crops should be well and continuously cultivated, which will help to bring them along quicker and with less watering. Late-bearing tomatoes should be sheltered from the cold winds by a grass shield. Beet, radish, carrot, parsnip, turnip, onion, leek, mustard, cress and tomatoes may be planted.

FORESTRY.

Care should be taken by further ploughing of land or burning of grass that all fireguards round plantations are in good order and effective. Thinnings where necessary may be continued, and fellings which are to be made are to be carried out. Cuttings may be taken and struck now of deciduous trees, such as the Carolina poplar. The pricking out of conifer seedlings into tins should be continued, and sowing of such seed for the coming planting season may be completed. A commencement may be made of preparation of land to be planted during the ensuing season, e.g., by stumping if necessary, and ploughing where practicable.

GENERAL.

Grazing is deteriorating, and the next few months may be a period of difficulty for the rancher. It is a mistake, frequently seen, for all the grazing nearest to the drinking places to be first consumed, so that later on the cattle, when least able to endure fatigue and when the grass is in any case most scanty and dry, have furthest to walk from the feeding ground to water. A little forethought can obviate this trouble. Live stock are usually in good condition at this time of year and able to travel longer distances to water than may be the case later on in the season. Fire guards to prevent grass fires should be looked to.

POULTRY.

The poultry keeper must be on the look-out for sudden cold snaps, for if some precautions are not taken, the production of eggs will drop.

This is one of the poultry keeper's busiest periods, but method, cleanliness and attention to details pay him well. Do not leave anything that you can spare the time to do yourself to natives. Watch carefully your breeding birds, and on the slightest sign of one going off, take him or her away; if left, you will have infertile eggs, weak germs, weak chicks difficult to rear, and later weak and unprofitable stock. See that the male bird has all the food he requires, and give him a meal by himself

twice a week, also a small piece of raw meat three times a week. Those who are using incubators should watch the temperature of the room on cold nights, for variations in temperature result in delayed and poor hatches, and often deformed chicks.

STOCK.

Cattle.—Cows with autumn calves should be kept in the more sheltered paddocks. A watchful eye should be kept on all watering places in order to prevent their being fouled or stopped up. Where winter calves are required, the bulls should be kept out of the herd until the end of July at least, and, in the meantime, they should be well fed and cared for in order to fit them for their work. The three watchwords in the dairy herd should be feed, shelter and bedding from now onwards. Ensilage will now be found invaluable, as also will pumpkins, majordas or any other form of succulent food. Good hay should be used to rack up with at night, and the maize ration should be supplemented with ground nuts, ground nut cake or bean meal. Young calves are better in the pen on very cold mornings until the sun has gained some power, when they may run on short, sweet veld for a few hours.

Sheep.—Continue to feed the ewes and lambs well. Older sheep should generally also be given some supplementary feed now. Sheep should not be allowed to get into low condition, especially in areas where parasite infection is to be feared.

DAIRYING.

At this time of the year the farmer should experience very little difficulty in producing cream of first-grade quality. During the winter months the separator should be adjusted so as to deliver cream testing 40 to 45 per cent. butter fat.

On exceptionally cold days care should be taken that the milk is not allowed to become too cold before separation—for efficient skimming, the milk should be separated immediately after milking and at a temperature not lower than 90 degrees F.

Farmers engaged in butter-making are usually successful in obtaining a good grain and firm body in butter at this season of the year. During cold weather it is frequently necessary to warm the cream for churning. The most satisfactory method of warming the cream to the proper churning temperature is to place the bucket or receptacle containing the cream in a tub or bath of water at a temperature of about 95 degrees F., stir the cream frequently and replace the water when cold.

Under the cool conditions which obtain from this time of the year onwards, cheese-making operations are usually most successful.

Care should always be exercised, however, in using evening's milk. If the milk is over-acid it should not be used, or a hard, dry cheese will result. Morning's milk plus a starter usually gives the best quality of cheese. The starter should have a clean sour taste and smell. In early winter, milk for cheese-making frequently contains a high percentage of fat, and in order to firm the curd properly in the whey it is usually necessary to raise the scalding temperature a few degrees.

At this period of the year winter feeding of dairy stock should commence in real earnest. The milking cows should now be in fairly good condition, and in order to maintain a full flow of milk throughout the cold, dry months of winter, it is essential that liberal feeding be practised. As far as possible an attempt should be made to imitate summer conditions by feeding an abundance of succulent and palatable food. Maize silage, sweet potatoes, pumpkins, etc., are very useful for this purpose, but these feeds should be supplemented by dry roughage of good quality, preferably a legume hay, and a liberal allowance of mixed concentrates.

For dairy heifers, weaned calves, etc., there is possibly no better ration than one consisting of maize silage, legume hay and mixed concentrates, and these feeds, if supplied in liberal quantities, should serve to keep the young stock in a thrifty, growing condition.

TOBACCO.

The grading of tobacco should be proceeded with. Any bales stored on the farm should be turned occasionally, especially where more than one bale is placed on another. Arrangements for the grading of tobacco seed should be made for the coming season. Growers purchasing tobacco seed should place orders early with distributors of reliable seed.

VETERINARY.

Horse-sickness should be practically over now. Redwater and gall-sickness occur all the year round, but the worst time is the summer, when ticks are prevalent. Blue tongue should be very little in evidence now. Inoculation can be carried out now. Scab is a poverty winter disease.

WEATHER.

Casual rains may occur, but except on the eastern frontier, none is to be reckoned upon, nor can it be regarded as seasonable or desirable. Frosts generally occur on a few nights during the month of June, and precautions must therefore be taken. This month and the next are the coldest of the year, and when the cold is accompanied by dull weather or "Scotch mist," known locally as "guti," it is apt to have a severe effect on live stock, especially if grazing should at the same time be scarce and water supplies far to travel to.

July.

BEE-KEEPING.

The warmer bees are kept during this month so much the stronger will they come out in the spring. Provide a thickness of 3 inches of cloth coverings over the frames, and where quilts are, on examination, found to be damp, replace them with dry ones. This is a favourable season to carry out repairs to hives. All section and shallow frame combs must be carefully stored away from ants and mice, as these will be wanted for the excellent honey to be stored in them next October, collected from the bush bloom.

CITRUS FRUITS.

The harvesting of mid-season oranges should be completed early in the month; late varieties should be fit to export by the middle of the month. The dead wood should be broken and cut out of all harvested trees; this will minimise mechanical injury occurring with next season's fruit. Trees that are to be fumigated should have the lower lateral branches that touch the soil removed. Trim the trees until all foliage is just clear of the ground. The irrigation of late varieties must be continued and the cultivators kept going. Mark all trees when in fruit if the quality is bad; these may be cut back in August for top working to a good quality fruit. The soil of the early and mid-season varieties may be allowed to become fairly dry, for irrigation of the harvested trees may start an out-of-season growth which will enable pests to flourish and increase for the main spring blossoming flush.

CROPS.

Support agricultural shows, and add to your list of exhibits. Advertise your goods through the shows. Interested people will see them. If you require to make purchases of seed for next season, judge by the exhibits on the show what grower can best supply your needs, and place your orders accordingly. Attend the shows and go there to learn all you can about your business, not merely to have a good time. Seed maize previously selected in the field should be butted and tipped and hand shelled. Keep the butt and tip grain for check-row planting by hand. Do not over-

irrigate winter crops, and do not irrigate when the wind is from the south, as this often means frost at this time of year. Troublesome weeds, such as darnel grass or drabok, may be removed from cereal crops by hand. Ploughing should be pressed on with, and maize stalks and roots of maize and other trash from the crop should be collected and burned very thoroughly. A land littered with unburnt and unrotted stalks and roots cannot be brought to a suitable tilth for planting and subsequent cultivation. Silage and sweet potatoes and other succulent feeds will have come into general use now, the potatoes being lifted from the land as required. The application of phosphatic fertilisers which are to be ploughed or harrowed in can be begun. Take the opportunity, during this and the next month or two, of inspecting all boundary and paddock fencing and gates, and effect repairs where required. Give a coat of paint to implements, wagons and carts. This protects the woodwork from rotting and the iron from rust.

DECIDUOUS FRUITS.

Pruning must be continued, and if possible completed this month. The planting of all varieties is best if done now. Add a liberal amount of water at planting time, then cultivate the basins. Sufficient moisture will be thus retained to keep the newly planted trees going until they start active growth. Repeat waterings when necessary. If trees arrive from the nurseryman in a dry and withered condition, immerse them in water for twelve or more hours until they regain turgidity; then plant. Running water is best. Keep cultivators going. It will be advisable to irrigate all trees towards the end of the month.

ENTOMOLOGICAL.

Cabbage Family.—Plants of this family suffer from cabbage louse and Bagrada bug during July. Young louse-infested cabbage should be sprayed regularly with a forceful stream of water to dislodge the insects; or if this fails, spray with tobacco extract and soap. The Bagrada bug is difficult to control. Strong tobacco wash and soap, resin wash or an oil spray may be effective, especially against the younger stages. Daily hand picking is useful. Keep plants growing vigorously.

Fig.—The winter crop of fruit is liable to suffer from fig weevil. The infested fruit should be collected and destroyed. If this has been done regularly with the first crop, the second crop is not likely to suffer much.

Maize Beetle.—Infested lands to be thoroughly ploughed throughout the winter.

FLOWER GARDEN.

Seeds of most annuals, perennials, shrubs and ornamental trees may be sown. The pruning of roses should be attended to early. Dahlias and other summer-flowering bulbs should be taken up, divided and replanted. Sweet peas require attention and staking.

VEGETABLE GARDEN.

Sow turnips, peas, cabbage, beet, carrots, parsnips, radishes, lettuce and spinach.

FORESTRY.

Care should be taken to protect all plantations from fire by hoeing or ploughing belts round them and burning any grass likely to be dangerous. Cuttings of various deciduous trees may be taken and struck in nurseries. Continue pricking out conifers into tins or beds. In preparation for early planting in case the season is favourable, limited sowings of tree seeds may be carried out. If labour is available, preparation of land for planting to be taken in hand.

GENERAL.

Veld fires must be watched for and arrangements made to combat them. The loss that may result and the penalties under the Herbage Preservation Ordinance are to be borne in mind. Fire guards should this month be burnt round all grazing which it is desired to preserve for use later on.

POULTRY.

With the cold weather that we generally have in July, the birds should have extra food, i.e., barley or maize, if the supply of eggs is to be continued. A mixture of stewed linseed and bran should be given to the birds, warm, the last thing before they go to roost. This gives them a little extra food during the long and cold hours of the night at this time of the year and maintains the body heat. A certain amount of shelter is also necessary to protect them from the cold winds. Grass wind breaks about 3 feet high on the windward side of the run are sufficient. Remember that no chickens should be hatched after August; those hatched later take much longer to develop than those hatched before August, and they are usually stunted, weakly and unprofitable. Each month the young stock should be gone through and graded; anything that does not promise to be good should be got rid of. As the hatching season draws to a close, the breeding stock, if not carefully watched and treated, will become run down, and infertile eggs and weak chicks will be the result. Watch the breeding stock carefully and handle them occasionally; if they feel thin and light or the flesh is not hard but flabby, give extra food and more scratching exercise. The male especially should be well looked after and given a meal on three or four days of each week by himself; in addition, he should have some raw meat as often as possible. Good hatching and strong, healthy chicks are wanted right up to the end.

Turkeys should now be in full lay. Never disturb the hens when they are sitting. They are very sensitive and nervous, and unless left mainly to themselves, are apt to desert the eggs or break them. It is recommended that turkey chicks be reared by hand; the hens are poor mothers, they are clumsy, drag their chicks all over the place, and do not feed them as well as an ordinary hen does. The main thing is to keep the young turkeys warm, give them plenty of fresh air, thick separated milk and chopped onions or onion tops.

STOCK.

Cattle.—The bulls may again be put into the herd at the end of the month. Watch for any unthrifty cattle and get them into the home paddock and feed them before they become really poor. The value of a good provision for winter feed will be apparent now. Except under purely ranching conditions winter feeding should be general. Where areas have been properly reserved for winter grazing these should be in use now. The treatment of the dairy herd should be continued on the same lines as in June.

Sheep.—Vleis should now be fairly dry and may be utilised. There is, however, always the danger of internal parasites, and, where feed or grazing can be provided elsewhere, it is better to avoid vleis.

DAIRYING.

This is one of the coldest months of the year, and milk production as a rule is low. Those cows which are being milked should receive a full winter ration of succulents (ensilage, pumpkins or majordas), hay and concentrates. Milking cows should either be under shelter at night or kraals should be sheltered against cold winds. The old adage, "Shelter is as good as a meal," should be remembered throughout the winter months.

No difficulty should be experienced in producing first-grade cream at this time. In cold, windy weather due precautions should be taken to ensure that the milk when separated is not below 90 degrees.

Most cheese-makers cease their cheese-making operations at the end of the month, as the milk generally not only is scarce, but begins to be deficient in butter fat. Cheese in the store-room should be carefully watched, as cheese mite is likely to appear on old mature cheese. In order to prevent the undue drying out of the cheese, the floor of the cheese room should be sprayed with water from a watering can.

Butter-making is sometimes difficult because of the low temperature of the cream. The temperature should be raised by immersing the can in warm (not hot) water until churning temperature is attained.

VETERINARY.

Horse-sickness and blue tongue should now have disappeared. Redwater and gallsickness occur all the year round, but the worst time is during the summer, when ticks are prevalent. Sheep may be inoculated against blue tongue now. Scab in sheep will probably be in evidence this month.

WEATHER.

Though rains have fallen during every month of the year in Rhodesia, none is looked for or desired this month. Most stations record an average of .01 to .3 inch over a number of years. Severe cold is likely to occur at this time of year, the lowest temperatures occurring an hour or two before sunrise. Frosts may be looked for, especially on calm clear nights. Cold windy days and damp "guti" weather tell severely on cattle, if shelter and food are not provided.

SALES.

AGRICULTURAL EXPERIMENT STATION, SALISBURY.

Spineless Cactus Slabs (blades) Algerian variety, per 100 slabs, 7/6 Salisbury, or 12/6 delivered free by rail to purchaser's nearest station or siding in Southern Rhodesia. For amounts of 500 slabs or more a reduction of 2/6 per 100 will be made.

Stocks are limited and delivery cannot be undertaken after 15th November.

Kudzu Vine Crowns, per 100 crowns, 15/-, Salisbury, or 25 crowns, 7/6; 50 crowns, 15/- and 100 crowns, 22/6, delivered free to purchaser's nearest station or siding in Southern Rhodesia. Delivery during September and October for irrigated land, and in January for dry land. Owing to pressure of other operations, it is not possible to deliver Kudzu crowns during November and December.

Woolley Finger Grass: 10s. per bag of roots, delivered on rail nearest station or siding; supplies limited. Available January and February.

The prices quoted above do not include charges for road motor transport. Cheques should be made payable to the Department of Agriculture, and preliminary enquiries and subsequent orders should be addressed to the Chief, Division of Plant Industry, Department of Agriculture, Salisbury.

SOUTHERN RHODESIA VETERINARY REPORT.

March, 1933.

AFRICAN COAST FEVER.

Melsetter District.—No mortality at any of the existing centres of infection.

FOOT AND MOUTH DISEASE.

As there had been no manifestation of foot and mouth disease in any part of the Colony since the last week in November, 1932, all restrictions on the movement of stock were withdrawn except in an area along the Bechuanaland Protectorate border. The measures adopted on this border have so far been successful in preventing the introduction of fresh infection.

TRYPANOSOMIASIS.

A number of fresh cases in cattle were reported from the Eastern Border Section.

HORSE-SICKNESS.

Twenty deaths were reported.

GALL-SICKNESS AND REDWATER.

Prevalent in various districts.

SHEEP SCAB.

One outbreak in the Melsetter district.

IMPORTATIONS.

From the United Kingdom: Horses, 3.

EXPORTATIONS.

To the United Kingdom: Frozen beef (boned), 457,174 lbs.

J. M. SINCLAIR,
Chief Veterinary Surgeon.

SOUTHERN RHODESIA WEATHER BUREAU.

APRIL, 1933.

Pressure.—Mean barometric pressure was about normal in the North and high in the South.

Temperature.—Both mean maximum and minimum temperatures were about normal, but during the first week of the month exceptionally high temperatures were recorded throughout the country.

Rainfall.—The average rainfall over the country was much below normal, being about half an inch. A considerable portion of W. Matabeleland and a number of stations in the Limpopo Valley and in the Midlands recorded no rain during the month. A fair amount fell on the south of the Eastern Border and around Zaka. Heavy thunder-storms were experienced around Salisbury on the 17th and 18th followed by light showers on the 19th and 20th. The month's total at Salisbury was 2½ inches, but as much as 5½ inches were recorded at the farm Selby.

The exact figure for the season's rainfall is not yet available, but, in spite of the phenomenal rains in January, the deficiency is somewhere in the neighbourhood of 4½ inches, which is in very satisfactory agreement with the forecast issued early in December.

APRIL, 1933.

Station.	Pressure Millibars, 8.30 a.m.		Temperature in Stevenson Screen ° F.								Rel. Hum.	Dew Point	Cloud Amt.	Precipitation.			Altitude (Feet).
			Absolute.		Mean.												
	Mean.	Normal.	Max.	Min.	Max.	Min.	½ Max. Min.	Normal.	Dry Bulb.	Wet Bulb.	%	F.	0-10	Ins.	Normal.	No. of Days.	
Bulawayo ...	871.7	870.3	91	43	77.7	53 6	65.7	65.9	64.7	56 3	59	50	4 4	.44	.67	3	4,436
Gwelo	864.9	...	89	44	77.2	53.6	65.4	65.5	64.0	56.1	61	50	3 4	.50	.71	2	4,638
Riverbank ...	...	...	97	45	84.2	55.5	69.8	68 0	65.5	56.8	58	50	...	.36	.64	3	4,100
Essexvale ...	...	...	100	40	83.9	53.8	68.8	67.4	61.0	56.4	75	53	...	.52	.59	4	3,828
Gwanda ...	908.7	...	95	42	80.5	55.2	67.8	...	67.1	59.2	63	54	3.7	.59	.51	1	3,235
Nuanetsi ...	...	...	100	45	80.7	57.5	69.1	...	69.3	63.4	73	60	5.6	.36	.53	3	1,630
Enkeldoorn ...	860.0	...	88	42	76.3	52.2	64.3	64.6	64.1	57.4	67	53	4.6	.35	.68	3	4,820
Gatooma ...	...	...	93	41	83.5	53.1	68.3	69.2	65.3	59.1	69	55	1.2	.30	.80	3	3,850
Miami	880.7	...	88	...	78.8	...	...	...	66.9	60.1	68	56	2.0	.93	1.29	4	4,090
Salisbury ...	856.7	856.7	89	44	77.6	53.1	65.3	65.5	65.1	57.8	64	53	2.7	2.57	.99	7	4,890
Sinoia ...	890.0	...	91	41	83.1	53.3	68.2	...	69.4	60.4	59	55	1.3	.29	1.00	4	3,804
Sipolilo... ...	...	...	86	47	78.0	56.2	67.1	...	68.1	60.5	64	55	1.1	1.49	1.30	5	3,900
Inyanga ...	...	...	83	41	72.5	51.2	61.9	...	64.6	55.7	57	49	2.2	.83	1.03	3	5,560
Bindura ...	...	...	91	44	80.3	56.5	68.4	...	67.0	60.5	69	56	2 4	.53	1.70	3	3,800
Angus Ranch ...	...	...	98	50	81.5	61 4	71.4	70.4	68.4	63.4	76	60	...	...	1.24	...	2,300
New Year's Gift	...	...	96	49	90.8	57.8	69.3	...	66.6	60.8	72	57	...	.58	.72	7	2,700
Rusapi ...	...	...	89	41	77.2	52.0	64.6	...	65.0	58.4	67	54	4 0	.29	1.20	3	4,640
Riverdene North	...	...	94	36	80.0	51.9	66.0	...	62.6	58.2	77	55	...	.81	.71	4	3,700
Stapleford ...	...	...	80	33	66.3	46 5	56.4	...	59.1	56.4	85	55	5.9	1.94	3.05	12	5,450
Umtali	895.2	895.2	95	46	79.0	55.7	67.3	66.2	67.5	61.1	69	57	4.3	.13	.99	4	3,677
Victoria ...	...	898 3	92	41	77.0	54.6	65.8	65.0	65.2	59.0	73	56	4.0	.80	.61	5	3,580
Melsetter ...	852.5	...	89	45	74.0	52.8	63.4	...	62.0	56.1	69	52	5.8	1.20	1.98	7	5,060
Mount Selinda	...	...	89	51	72.9	57.0	65.0	...	64.0	59.4	76	56	4.8	4.24	3.41	12	3,520
Manchester ...	...	...	80	40	69.1	51.5	60.3	...	56.5	53.9	85	52	...	.86	...	6	...

DEPARTMENTAL BULLETINS.

The following Bulletins, consisting of reprints of articles which have appeared in this Journal, are available for distribution at 3d. per copy. Application should be made to the Editor, Department of Agriculture, Salisbury, and remittances must accompany orders.

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No. 374. Fibre Crops—Deccan Hemp (Hibiscus Cannabinus) and Sunn Hemp (Crotolaria Juncea), by J. A. T. Walters, B.A.

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No. 510. Check-row Planting of Maize, by H. G. Mundy, F.L.S.

No. 545. Artificial or Synthetic Farmyard Manure, by H. G. Mundy, Dip.Agric., F.L.S.

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No. 697. Results of Analysis of Samples taken under the "Fertilisers, Farm Foods, Seeds and Pest Remedies Ordinance" during the year 1927-28.

No. 704. The Importance of Research on Pasture Improvement in Southern Rhodesia, by A. D. Husband, A.I.C., Chief Chemist.

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REPORTS ON CROP EXPERIMENTS.

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Points to be observed in Cream Production.

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No. 874. Tree Planting, by the Division of Forestry.
Price List of Forest Tree Transplants, Ornamental Trees and Shrubs, Hedge Plants, Creepers and Seeds.

HORTICULTURE.

No. 471. Budding of Citrus Trees, by A. G. Turner.
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ENTOMOLOGY AND PLANT PATHOLOGY.

No. 139. Termites, or "White Ants," by Rupert W. Jack, F.E.S.

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No. 219. More Household Insects, by R. Lowe Thompson, B.A.

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No. 385. The Common Fruit Beetle, by R. W. Jack, F.E.S.

No. 425. Notes from the Entomological Branch, by Rupert W. Jack, F.E.S., Chief Entomologist.

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No. 613. Two Diseases of the Vine, by F. Eyles, Mycologist.

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No. 654. Root Gallworm or Root Knot Eelworm (Heterodera radicicola, Greef), by Rupert W. Jack, F.E.S.
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No. 714. Trap Cropping against Maize Pests, by Rupert W. Jack, F.E.S., Chief Entomologist.
No. 718. Preliminary Experiments on the Control of White Mould of Tobacco, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A., Chief Botanist and Mycologist.
No. 732. Two Common Diseases of Potato Tubers in Rhodesia, by J. C. F. Hopkins, B.Sc. (London), A.I.C.T.A.
No. 742. What is Diplodia in Maize? An Answer to a Popular Question To-day, by J. C. F. Hopkins, B.Sc. (London), A.I.C.T.A., Chief Botanist and Mycologist.
No. 747. Mycological Notes: (1) Seed Treatment for Maize against Diplodia; (2) Seed Treatment for Tobacco against Bacterial Diseases. Issued by authority of the Minister of Agriculture and Lands.
No. 748. Frog Eye Disease of Tobacco, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A., Chief Botanist and Mycologist.
No. 753. Leaf Spotting of Tobacco caused by Mosaic, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A., Chief Botanist and Mycologist.
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No. 788. A List of Plant Diseases Occurring in Southern Rhodesia, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A., Plant Pathologist.
A List of Plant Diseases Occurring in Southern Rhodesia, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A., Plant Pathologist. Supplement No. 1.
No. 790. Notes on the Control of Some of the More Important Insect Pests of Citrus in Southern Rhodesia, by W. J. Hall, Ph.D., B.Sc., Entomologist to the British South Africa Company in Southern Rhodesia.
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No. 798. The Preparation of Bordeaux Mixture and Seasonal Notes on Tobacco Diseases, by J. C. F. Hopkins, B.Sc. (London), A.I.C.T.A.
No. 804. Locusts in Southern Rhodesia, by Rupert W. Jack, Chief Entomologist.
No. 825. Some Common Diseases of Potatoes in Southern Rhodesia, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A., Government Plant Pathologist.
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No. 848. Mycological Notes: Seasonal Notes on Tobacco Diseases—3, Frog Eye; 4, White Mould; by J. C. F. Hopkins, B.Sc., London.
No. 856. A List of Plant Diseases occurring in Southern Rhodesia, Supplement 2, by J. C. F. Hopkins, B.Sc. (Lond.), Government Plant Pathologist.

No. 861. Further Notes on Leaf Curl of Tobacco in Southern Rhodesia, by J. C. F. Hopkins, B.Sc.(Lond.), Plant Pathologist.
No. 868. Cultural Methods and Tobacco Whitefly in Southern Rhodesia, by M. C. Mossop, M.Sc., Entomologist.

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No. 721. Poultry Keeping in Rhodesia : Pedigree Breeding, by H. G. Wheeldon, Assistant Poultry Expert.
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No. 738. Hints to Breeders—Rearing Young Stock, by A. Little, Poultry Expert.
No. 740. Artificial Incubation, Brooding and Rearing of Chickens, by H. G. Wheeldon, Poultry Expert.
No. 761. Housing and Feeding of Adult Stock, by H. G. Wheeldon, Poultry Expert.
No. 795. The Turkey, by G. H. Cooper, Assistant Poultry Officer.
No. 803. Geese, by G. H. Cooper, Assistant Poultry Officer.
No. 827. The Ideal Brooder, by F. Roberts, Assistant Poultry Officer.
No. 865. Poultry Industry: Care of Young Stock in Hot Weather, by H. G. Wheeldon, Chief Poultry Officer.
No. 870. Trap Nests, by B. G. Gundry, A.I.Mech.E. (combined with No. 875).
No. 872. The Poultry Industry: Rearing and Fattening of Table Poultry, by H. G. Wheeldon, Chief Poultry Officer.
No. 875. Another Trap Nest, by B. G. Gundry, A.I.Mech.E. (combined with No. 870).

The following pamphlets can be obtained from the Poultry Expert upon application :—

Selecting Birds for Laying Tests, by A. Little, Poultry Expert.
Tuberculosis, by A. Little, Poultry Expert.
Prevention of Disease among Poultry, by A. Little, Poultry Expert.
Preparing Birds for Show, by A. Little, Poultry Expert.
The Fowl Tick (Argas persicus), by A. Little, Poultry Expert.
Culling : A Seasonal Operation, by A. Little, Poultry Expert.
Choosing a Male Bird, by A. Little, Poultry Expert.
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Diseases of the Digestive System, by A. Little, Poultry Expert.
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Advice to Prospective Poultry Farmers, by A. Little, Poultry Expert.
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Successful Chick Rearing, by H. G. Wheeldon, Assistant Poultry Expert.
Hints to Breeders, October, by A. Little, Poultry Expert.
Abnormalities in Eggs, by A. Little, Poultry Expert.
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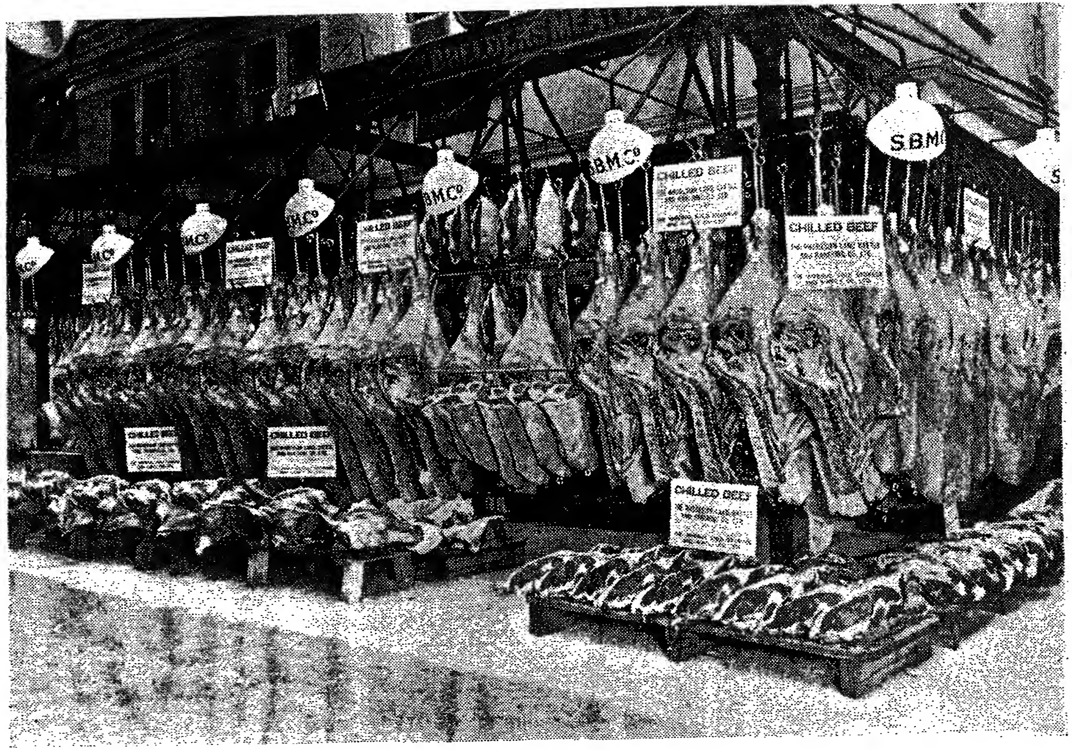
Respiratory Diseases, by A. Little, Poultry Expert.
Selection and Preparation of Fowls for Exhibition, by H. G. Wheeldon, Poultry Expert.
The Close of the Hatching Season and After, by H. G. Wheeldon, Poultry Expert.

METEOROLOGICAL.

No. 360. Notes on the Rainfall Season 1919-20 in Southern Rhodesia, by C. L. Robertson, B.Sc., A.M.I.C.E.
No. 436. The Possibility of Seasonal Forecasting and Prospects for Rainfall Season 1922-23, by C. L. Robertson, B.Sc., A.M.I.C.E.
No. 524. The Use of an Aneroid Barometer, by C. L. Robertson, B.Sc., A.M.I.C.E.
No. 532. The Short Period Forecast and Daily Weather Report, by C. L. Robertson, B.Sc., A.M.I.C.E.
No. 542. Review of the Abnormal Rainfall Season 1924-25, by C. L. Robertson, B.Sc., A.M.I.C.E.
No. 712. The Time, and How to Find it, by N. P. Sellick, M.C., B.Sc. (Eng.).
No. 832. The Weather Map and the Short Period Weather Forecast, issued by the Meteorological Office.
No. 877. Clouds and Weather in Southern Rhodesia, by N. P. Sellick, M.C., B.Sc., Meteorologist.

MISCELLANEOUS.

No. 518. Locusts as Food for Stock, by Rupert W. Jack, F.E.S.
No. 554. Pisé-de-Terre, by P. B. Aird.
No. 574. Brick-making on the Farm, by A. C. Jennings, Assoc.M.Inst.C.E., A.M.I.E.E.
No. 588. Concrete on the Farm, by N. P. Sellick, M.C., B.Sc. (Eng.), Assistant Irrigation Engineer.
No. 686. The Land Bank, Its Functions and How it Operates, by S. Thornton.
No. 687. The Use of Explosives on the Farm, by P. H. Haviland, B.Sc. (Eng.).
No. 702. Book-Keeping on the Farm, by T. J. Needham, Acting Accountant, Agricultural and Veterinary Departments.
No. 707. Wood-Charcoal in Southern Rhodesia, by T. L. Wilkinson, B.Sc., Assistant Forest Officer.
No. 849. The Preservation of Farm Beacons, by L. M. McBean, Acting Surveyor General.
No. 852. Mixing of Fertilisers: A Guide to Methods of Calculation, by the Division of Chemistry.
No. 858. The Softening of Waters, by the Division of Chemistry.
How to Make Use of the Fencing Law.
Twelve Simple Rules for the Avoidance of Malaria and Blackwater.
Summary of the Game Laws of Southern Rhodesia



Rhodesian Chilled Beef at Smithfield.

THE RHODESIA

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(Assisted by the Staff of the Agricultural Department).

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VOL. XXX.] JULY, 1933. [No. 7

Editorial.

Contributions and correspondence regarding subjects affecting the farming industry of Southern Rhodesia are invited. All communications regarding these matters and advertisements should be addressed to:—The Editor, Department of Agriculture, Salisbury.

Rhodesian Chilled Beef at Smithfield.—The photograph reproduced opposite shows a splendid display of Rhodesian chilled beef. This was the second of the recent shipments made by the Imperial Cold Storage Company and was shipped on the "Carnarvon Castle." The cattle came from the Nuanetsi Ranch and averaged 660 lbs. dead weight, and the dressing and condition of this shipment was favourably commented upon. In submitting the photograph to the High Commissioner's office the head of the firm which handled the meat wrote:—

"I think you will agree that the photo shows up very well indeed, and we congratulate Rhodesia on the improvement she is steadily making in the get-up of this commodity.

"Needless to say no efforts will be spared on our part to give every possible assistance to your shippers to build up this industry, which we consider is so essential to Rhodesia."

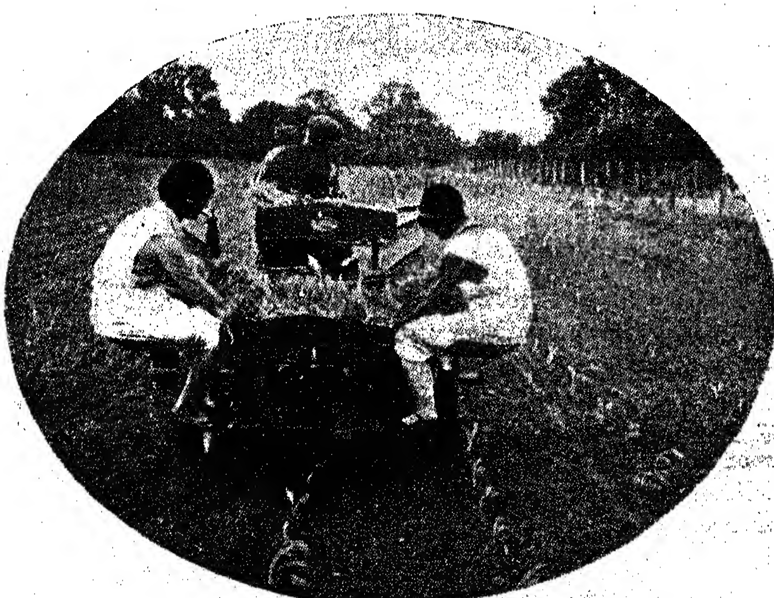
Rhodesian Wheat.—The quality of wheat depends, to a large extent, upon its protein content, and during the last few seasons special attention has been devoted to this character. From a plant breeder's point of view the quality of the grain is perhaps the most important one, since it is no good producing a wheat which proves to be unsatisfactory from a milling and baking point of view. Mr. T. K. Sansom, Plant Breeder of this Department, has grown several hundreds of varieties of wheat during the last 5 years and the chemical composition of the grain is looked upon as one of the most important criteria for judging the results. About five years ago the Honourable Lionel Cripps brought a sample of "Reward" wheat from Canada, and this was included in the wheat breeding experiments. For the first two seasons it was grown during the summer on the Salisbury Experiment Station, but the majority of the plants suffered very severely from rust. Selections were made by Mr. Sansom and grown during the winter of 1930 at Marandellas on wet vlei soil under unfavourable conditions, but the hardiness of the variety was shown to a remarkable degree. With the closing of the Marandellas Station the wheat breeding experiments were transferred to the Tobacco Research Station, Salisbury, and during the winter 1932 about 100 pounds of "Reward" seed reaped. On analysis this proved to possess the highest protein content of any wheat grown in Rhodesia, *viz.*, 3.11 Nitrogen, or 17.7 Protein.

Through the kind services of Mr. Russell Ridgway, the Managing Director of the Rhodesian Milling and Manufacturing Company, a sample was sent to Dr. D. W. Kent Jones, of the Dover Laboratories. The report received indicated that the protein content was very good indeed and the general strength figure was very satisfactory. The dough had good properties when mechanically tested, but it was not so good, in their opinion, as some Manitobas.

This wheat is undoubtedy the best which has yet been produced in this Colony, and during the present season is being put to further tests. Small quantities have been distributed to farmers in the Umvuma, Enkeldoorn, and Melsetter districts, and a further lot is being tried out against 40 other varieties in the Umvuma district. The remainder is being

bulked up on the Tobacco Station. It will be realised that it has not yet been proved for yield, but if it shows itself to be satisfactory it is hoped that a considerable amount will be available for more general distribution during the next few seasons.

The Robot Planter.—Particulars have been received of a planter which, it is stated, will plant from seven to twelve thousand plants an hour, depending upon the distance apart. It is claimed to give results with such plants as cabbage, swedes, celery, strawberries, fruit tree cuttings and forest seedlings, superior to hand planting, and the testimonials and press reports given would indicate that the claim is justified.



The planter opens up a continuous furrow giving ample space for the roots, at a uniform depth regulated to suit the particular plant. The plants are fed to the machine, which grips them in a manner said to be without injury to the most delicate plants, and automatically planted at regulated distances apart. The plants are released at the moment the rear compressing wheels firmly consolidate the soil around the

roots. A watering device can be provided which supplies a regulated quantity of water to the root of the plant before the ground is filled in by the machine.

The price of the machine in England is £60, and full particulars can be supplied by the manufacturers, Transplanters, Ltd., 41, Moorfields, London, E.C.2.

Poultry Foods now included in Farm Foods Ordinance.—The attention of poultry farmers, poultry food manufacturers and dealers is called to the fact that since the 21st April, 1933, poultry foods are included in the schedules of the Fertilisers, Farm Foods, Seeds and Pest Remedies Ordinance.

Under this Ordinance every importer of poultry foods and every proprietor or manufacturer of a poultry food for sale must register annually such food with the Secretary, Department of Agriculture, before the 31st of March each year.

The sale or delivery of any poultry food unregistered in the terms of these regulations is prohibited, and any person who sells or delivers such unregistered poultry food shall be guilty of an offence.

At the time of registration full details have to be supplied concerning the composition of the poultry food then registered, and the sale or delivery of any poultry food whose chemical constitutents are, within specified limits, less than the quantity or proportion thereof as stated in the particulars furnished upon registration, is prohibited, and any person who sells or delivers any such deficient poultry foods shall be guilty of an offence.

Export of Chilled and Frozen Meat to the United Kingdom.—With a view to making the fullest enquiry possible into the Chilled and Frozen Meat trade in Great Britain the Government has decided that Dr. A. E. Romyn, Senior Animal Husbandry Officer of this Department, will proceed to England in the near future to accompany a consignment of chilled meat on the journey by rail to Cape Town and thence by Union-Castle steamer to the United Kingdom.

There are a number of points upon which further information is desirable, particularly in respect of temperatures on board ship, condition of the meat on arrival in Great Britain, and its suitability to different local markets in the United Kingdom.

In addition to accompanying the shipment referred to Dr. Romyn will remain in England for two or three weeks in order to meet other shipments on arrival at the docks and to follow their progress through the Smithfield and provincial markets.

Questions in connection with refrigeration will also be discussed with the officials of the Low Temperature Research Station at Cambridge.

Farmers' Day at Marandellas Pasture Research Station.—About forty members of the Marandellas and neighbouring Farmers' Associations were present at the lecture and demonstration on the Pasture Research Station, Marandellas, on 2nd June. Mr. A. D. Husband, Chief Chemist, in welcoming the visitors to the Station on behalf of the Department of Agriculture, stated that the Minister for Agriculture, the Acting Secretary, and the Director had hoped to be present, but had unavoidably been detained in Salisbury, and sent their apologies.

Mr. Husband outlined the general principles underlying the work of Pasture Research—the management and improvement of the existing veld flora—and stressed the world-wide importance of this problem. He then gave a detailed account of the work in progress on the Station, indicating the results which had been obtained, and showing how the carrying capacity of the land had been greatly increased as a result of the combined effect of stumping and mowing. The results from fertilisation had been somewhat disappointing on the Station. Manuring with phosphates alone had but very little influence on either the quantity or quality factor of the herbage. Phosphate and potash combined had improved the quantity factor, and although chemical analysis showed very little influence on the quality factor, it would appear from the condition of the cattle grazing on the plots treated with these

two fertiliser elements that there was a small influence on the quality factor. The most marked effect obtained in the fertiliser trials was from the paddocks fertilised with a mixture of phosphate, potash and nitrogen. This treatment had had a marked effect on the quantity factor, and appeared generally to have improved the quality factor. It seemed, therefore, that the element most effective in improving pastures on soil of the nature on this Station was nitrogen.

Comparisons were made with the results from the Station at Matopos where, in spite of two seasons containing long drought periods, the cattle had maintained their condition. At Marandellas, on the other hand, the quantity factor had been more than sufficient and yet the cattle were in very poor condition after two years. The craving for salt by the cattle at Marandellas was in marked contrast to the lack of desire for it on the part of those at Matopos. Mr. Husband stated that he had been led from a study of the literature to suspect a nutritional anæmia in the cattle at Marandellas. Accordingly the hæmoglobin content of the blood from a number of the animals was estimated and found to be appreciably lower than that of stall fed cattle. This test was carried out very simply by means of the Tallquist Hæmoglobin Scale. It was explained that although this test was not of the accuracy usually adopted in scientific laboratories when making blood counts, it was an excellent and rapid method for comparative work and could be carried out in a few minutes on the farm.

Following up this investigation salt licks were supplied to the animals. One group received salt alone, another iron alone, and a third salt plus iron. Although this had only been carried on for two months, the results were most promising and showed a considerable increase in the hæmoglobin content of the blood.

The complete salt lick given was that recommended by Becker, Neal and Shealy in America, and consists of 100 lbs. salt, 25 lbs. red oxide of iron, and 1 lb. copper sulphate. In preparing the lick the salt and iron oxide are mixed together, the copper sulphate dissolved in a small quantity of water and watered on to the mixture.

A set of photographs was passed round which readily showed the marked improvement in the condition of the animals.

Great interest was shown throughout the lecture, and numerous questions were asked at its conclusion. The party then inspected the stock and paddocks and obtained a fuller idea of the practical work of the Station. Advantage was taken of the opportunity of inspecting the grass plots laid down in the wet vlei by the Division of Plant Industry. There Mr. D. E. McLoughlin explained the object of the work and indicated the species of grass which would be worth establishing.

Export of Frozen Porkers.—In the last issue of this journal an account was given of the campaign in progress to get together an experimental shipment of frozen porkers to send to Smithfield. It has now to be reported that despite good organisation on the part of the Rhodesia Agricultural Union, it has not been possible to collect sufficient porkers to justify a trial shipment this year.

The most cogent reason advanced for the lack of support was "the low price that would be realised." This is in spite of the fact that a net return at Bulawayo was guaranteed to the farmer of 4d. per lb. dead weight, which is probably not less than 25 per cent. over the export value of the pigs. Local prices at present are, however, above this figure and the failure to volunteer is understandable.

The response, however, indicates a definite lack of co-operation among producers. If exporters expect and stand out for a return equal to the local price there is small hope of any trade in the visible future. The export trade should be looked upon as an outlet for surplus pigs to start with and as a means of stabilising the local market. Producers should clearly realise that until an export trade is developed it will neither be possible to build up an important industry in this Colony nor to achieve any stability of prices.

No successful system of mixed farming has been built up without the pig and, until it plays a more important part in

the agricultural production of this Colony than it does at present, the mixed farmer will not get full value for his maize, separated milk or other by-products. In fact, in intensive dairying countries, the profit in dairying is not infrequently reckoned as the value of the separated milk fed to pigs.

The first step would appear now to bring these truths home to the farmers. In this the various Agricultural Unions and Farmers' Associations can assist. This Department will always be glad to co-operate, supply the necessary information and, if necessary, officers to explain the situation as well.

Some measure of close organisation is necessary before the industry can be placed on a sound footing. Unless the pig farmers will get together and organise their case it is difficult for this Department, or anyone else, to help them. If they don't do so, there is little room for expansion in the pig business, and the industry will continue to remain at the mercy of a small local market.

Maize for Export.—The following warning is published in the belief that growers will give full attention to this matter and thereby save themselves much trouble and annoyance through their maize being held up for export on account of an unduly high moisture content, or failure in other respects to comply with the export regulations. The regulations apply not only to maize for export overseas but also for export overland to any other part of Africa—a point which growers should not lose sight of. Maize consigned to any point outside the boundaries of Southern Rhodesia, is deemed to be exported, and must therefore comply with the regulations.

"*No maize shall be permitted to be exported which contains more than* $12\frac{1}{2}$ *per cent. of moisture.*"

Difficulty has been experienced at the commencement of each export season by reason of the large amount of damp maize offered for grading, and large consignments have annually been temporarily rejected by the Government graders on this account.

It rests with the producer to see that his grain is offered for export in a fit condition, and if he fails to do so, he has no one to blame but himself.

It is sincerely hoped that this warning, together with the suggestions which have been offered in the past, will have the effect of inducing maize growers to give more attention to these matters and to save themselves much worry and unnecessary loss.

Practical Sheep Farming.*—A copy of "Practical Sheep Farming," by Tom C. Norris, has been sent to us for review. It is written from an unusual viewpoint: that of the reaction of the sheep and its response to handling. It abounds in practical observations and hints which a sheep man will appreciate.

The author, who has had a great deal to do with sheep, is at his happiest in those chapters in which he describes the easiest and most efficient ways of mustering, handling, marking, mothering, weaning and shearing sheep. His chapters on breeding and classing do not contain the detail or give the exact or scientific information characteristic of the best of the Departmental publications in the Union.

A good deal of the information given applies more to sheep handled on an extensive scale, as in the Argentine, than to the small farm flocks typical of this country. There is, however, much general information which will be of value to sheep farmers in any country.

Except for scab, diseases as not dealt with.

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*(Published by George Allen & Unwin, Ltd., London 10/6 net.)

The Economics of the Rhodesia Tobacco Industry.

MARKETING AND DISPOSAL OF THE CROP.

By D. D. Brown, Chief Tobacco Officer.

Paper read before the Rhodesia Scientific Association, May, 1933.

Further interest may be added to our subject by briefly tracing the development of tobacco through past centuries, its association firstly with religious ceremonial and eventually as a widely used means of social enjoyment. In its rise to fame, tobacco has advanced from the state of a weed to that of a highly cultivated plant of major social and economic importance. As a source of revenue this erstwhile weed has gradually become supreme so far as plant products are concerned. In all civilised countries tobacco now is an important source of revenue. To its smoking qualities is the advancement of tobacco due.

Early in the history of man fire was a sacred phenomenon and the burning of fragrant herbs and sweet-scented fumes led to the origin of incense. The practice of burning incense to their gods was borrowed from the earlier religions by the Greeks, Romans and Hebrews. Later smoke was applied not only to religious ceremonial but also medicinally. The inhalation of smoke as a cure for certain diseases and complaints was recommended by both Hippocrates and Pliny. Herodotus records that about 450 B.C. the Scythians, inhabiting the lands now known as Bulgaria and Greece, used to inhale the intoxicating smoke from hemp seed thrown on hot stones.

The habit of smoking as a means of social enjoyment was totally unknown to the nations of the Old World during classical or medieval periods, and the custom was subsequently introduced from the New World, where the habit was prevalent long before the advent of white men to those shores. The

custom of smoking played an important part in many religious ceremonies, and the beliefs and observances connected with it are in themselves proof of its antiquity. Hundreds of pipes have been discovered in the pre-Columbian mounds and village sites of the eastern United States. In the south-western United States the Basket Makers, an ancient people whose remains are found beneath those of the Cliff Dwellers, were smoking pipes at a time which could not have been much later than the beginning of our era. Records in stone, of the Mayas, who during the period 100 B.C. to 600 A.D. inhabited the land now known as Mexico, afford definite evidence of smoking. The Mayas were sun worshippers and part of their ritual seems to have been to blow incense out of an object resembling a pipe, in the direction of the sun and the four quarters of the world. The priests not only were the representatives of their gods, but they were also the medicine men. They credited tobacco with healing powers, and this belief was later carried to Europe. The weed was used as a fuel for the sacred fires of the priests of Central America and was known as Yetl or Picietl.

Smoking, meanwhile, had spread as a social habit among the Aztecs, who inhabited the remainder of what is now known as Mexico. Somewhere about 600 A.D., according to Radin, there was a migration of Mayas to Yucatan and up the Mississippi. Evidence of their occupation has been discovered in the Ohio Valley, where pipes ornamented with carvings representative of birds and creatures which existed only in Central America and the Antilles have been found. The use of smoke may possibly have been carried North by the wandering Mayas, who, continuing their use of smoke in religious ceremonial, may have introduced this form of worship in North America. There is a similarity, for instance, between the ritual followed by the Mayas and the religious ceremonies of the Hopi, whose head chief blew smoke to the world quarters and over the altar as a preliminary to his invocation. Among all the tribes east of the Rocky Mountains tobacco, named by the Indians uppówoc, was the favourite offering to their great god—Manitou—and to other gods of the Indian pantheon. As a sacrifice it might be burned as incense, cast into the air or buried in the ground.

Smoking was indulged in on all solemn occasions, such as councils, and was a necessary part of most religious ceremonies of all tribes even as far north as Canada. Meantime the Aztecs, whose capital city occupied the site upon which now stands the City of Mexico, had brought under their dominion the neighbouring tribes and thus the whole of Central America became acquainted with smoking. Eventually the practice was also carried to the countries now recognised as Venezuela, Guiana and Brazil, tobacco being known there as Petum. The Spaniards at a later date carried the habit of smoking to the rest of South America. There was thus a long history of smoking, both as a religious rite and for political and social purposes, in America prior to the arrival of white men in that land. Knowledge of the use of tobacco by the aborigines of America was carried to Europe by Christopher Columbus and members of his expedition who, in 1492, found the natives of Cuba inhaling smoke. One member of the expedition, Rodrigo de Jerez, is said to have introduced the habit into Spain as a result of which he suffered imprisonment by the Inquisition, later being released only to find many of his compatriots indulging in the weed. Described by Oviedo, in 1526, the method of inhalation practised by the priests of America was through the nostrils. For this purpose was employed a Y shaped tube, the two forked extremities being inserted in the nostrils and the single end in the burning weed. Those who could not obtain this type used instead a hollow reed, and according to Oviedo it was this pipe which then was called tobacco and not the plant itself. The inhalation of smoke through the nostrils produced a state of stupor, and when insensible the smoker was wrapped in a hammock, suspended in a convenient place, and remained there until the effects of the narcotic were dissipated. Cabral, in 1500, found the habit of smoking practised in Brazil, but Pizarro found no trace of smoking among the Incas of Peru. On the west coast of South America and in the Andean highlands the aborigines used another narcotic, coca (*Erythroxylum coca*), from which the modern drug cocaine is extracted. The coca leaves were dried and chewed with powdered lime. Cortez, landing in Mexico in 1519, noted the cultivation of tobacco and the habit of snuffing, pipe smoking was also indulged in, and fresh tobacco leaves were used in healing wounds. John

Hawkins observed, in 1564, that the French in Florida used tobacco for the same purposes as the natives. La Casas admitted that the Spaniards in Cuba who had contracted the habit could not be weaned from it. The French settlers in Canada also adopted the habit from the savages and smoked the tobacco which was imported from Brazil. Gabriel Soares de Souza (Noticia do Brazil, 1587) who resided in Brazil from about 1580, records that tobacco leaves were highly regarded by Indians, Negroes (whom he calls Mamelucos), and Portuguese, who "drank" the smoke by placing together many leaves wrapped in a palm leaf; they used, accordingly, the cigar. These Brazilian cigars were considered good for relieving a cough, headache, and complaints of the stomach. The English colonists of Virginia soon adopted the aboriginal custom of pipe smoking. Tobacco is native to the sub-tropical regions of the continent of America, and it constitutes one of the most important gifts from the New World to the Old. The North American Indians used at least nine species of *Nicotina*, most of which were cultivated. *Nicotiana tabacum*, the species to which practically all the modern commercial tobaccos belong, was grown throughout Mexico, the West Indies, and in northern and eastern South America. It was unknown north of Mexico until its introduction into Virginia by the English colonists. *Nicotina rustica*, a much hardier species with a yellow flower, was grown by the Indians of the eastern United States and Canada. It was the first tobacco grown in Virginia for the European trade, but was soon supplanted by *N. tabacum*. Tobacco seed was introduced into Europe in the year 1558, and in the following year Jean Nicot arrived in Lisbon as Ambassador for France. Here he saw the cultivation of tobacco and having heard of its curative and medicinal powers, Nicot sent seed of this wonderful plant to Catherine de Medici. For which service Nicot's name has ever since been associated with tobacco. Because of its reputed medicinal qualities, tobacco soon became famous, and for many years was this reputation maintained throughout Europe, where it was cultivated as a medicinal herb. Tobacco was carried to the coasts of Africa and the west coast of India, and later to the Far East by the seafaring adventurers of that period. From the coastal regions cultivation of tobacco subsequently extended far into the

interior of Africa. From India, followed later by Japan, tobacco found its way over eastern Europe and eventually linked up with the movement which had extended eastwards from Portugal and France and thus completed the progress of tobacco throughout the entire continent.

Sir John Hawkins, returning from his second voyage to the West Indies in the year 1565, introduced tobacco and smoking into England. To Sir Walter Raleigh is credit due for popularising the smoking habit among the Britons. To the advocacy of Hawkins, Raleigh and their contemporaries, to whom the use of tobacco appealed, is due the early commercialisation of tobacco, first in England, where in the year 1586, pipes were in full blast, and then the Continent, where tobacco had been regarded chiefly for its reputed medicinal properties.

The art of smoking was at first confined to sailors and those with whom they came in close contact. The habit then spread inland from the seaports. In Europe smoking gradually spread despite the antagonistic attitude of Kings and Rulers who, with their edicts and the imposition of severe penalties—in some cases the death penalty—failed to prevent the constant increase in the use of tobacco. At this time the West Indies tobacco was much sought after and monopolised the market. Cultivation of the weed by the colonists of Virginia commenced about the year 1612; they then set about improving the quality of their product, and, by the use of seed imported from the West Indies, soon succeeded in making the smoking qualities of Virginian leaf comparable with that of the West Indies. Tobacco from Virginia and Maryland promptly became a leading article of exchange with the Motherland. The colonists soon succeeded in ousting their competitors and established the Virginian tobacco on all the principal markets in Europe, where the demand for it has flourished for the past 300 years. The first exportation of leaf from Virginia in any significant quantity occurred in 1619, when 20,000 lbs. were shipped to England. From this modest beginning has grown an export trade amounting to some two hundred million pounds of American tobacco annually imported by Great Britain. A further sixty to seventy million pounds are also exported from the United States of America to the Dominions

and Colonies. The British Commonwealth, therefore, annually imports approximately two hundred and seventy million pounds of tobacco from the United States of America. Though for so long in complete supremacy of the British market, American tobacco is now being challenged by the Colonial product. The exportation of Empire tobacco to the United Kingdom had not attained a degree of significance until comparatively recent years. Progress proved at first slow and often disappointing. However, after the difficulties encountered during the initial stages had been successfully overcome, there was a distinct improvement in the rate of progress made in the establishment of Colonial tobacco on this market. Imports of Empire tobacco into the United Kingdom have increased from 40.9 million pounds in the year 1927 to 47.8 million pounds in 1932, an increase of 17%. The total quantity of tobacco imported annually into Great Britain is as follows:

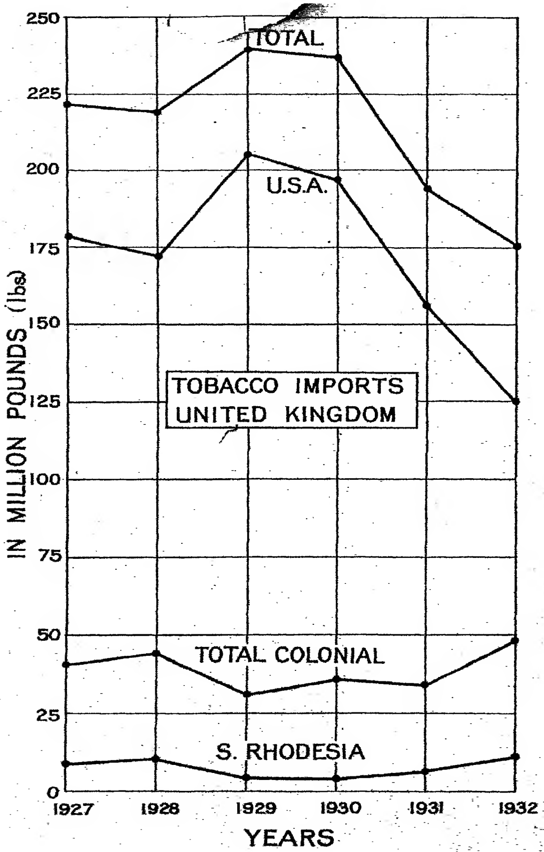
Imports of Tobacco into the United Kingdom.
In Millions of Pounds.

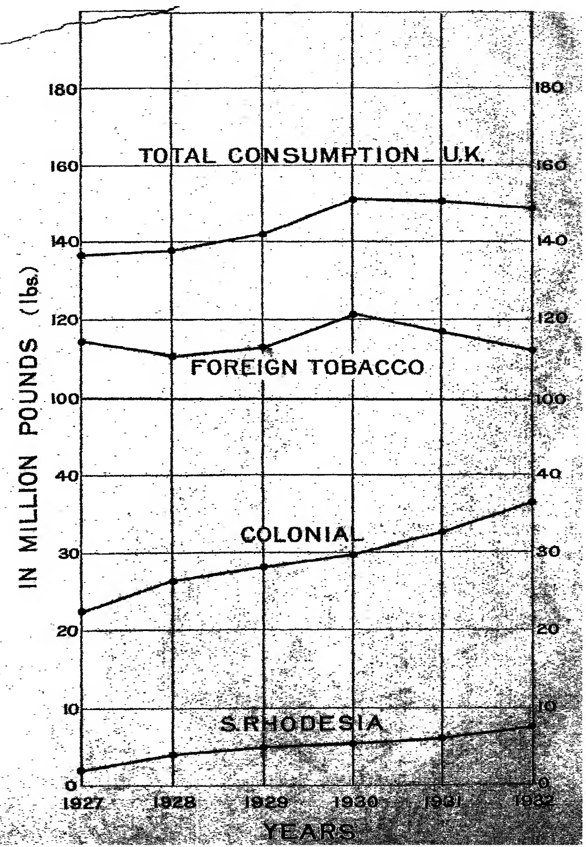
	1927.	1928.	1929.	1930.	1931.	1932.
U.S.A.	177.5	172.3	205.2	197.6	157.1	125.2
Foreign...	3.8	2.9	3.0	3.7	2.7	2.0
Colonial...	40.9	44.2	31.6	35.5	34.2	47.8
Total...	222.3	219.5	239.9	236.9	194.1	175.2
S. Rhodesia...	9.2	10.2	4.0	3.6	5.8	10.4

It will be observed that the imports of Colonial tobacco increased by 3.3 million pounds in 1928, whilst the U.S.A. imports decreased by 5.2 million pounds and the total imports by 2.8 million pounds; the Colonial imports during 1929 fell by 12.6 million pounds and the U.S.A. imports increased by 32.9 million pounds, thus increasing the total imports by 20.4 million pounds. In 1930 there was a rise of 3.9 million pounds in the imports of Colonial tobacco, a decrease of 7.6 million pounds in the U.S.A. and 3 million in the total imports. There followed a decrease of 1.3 million in the Colonial imports and a drop of 40.5 million pounds in the imports from the U.S.A., the total imports decreased by 42.8 million pounds in 1931. During the following year there was an increase of 13.6 million pounds in the Colonial imports, whilst the

U.S.A. and total imports decreased by 31.9 million pounds and 18.9 million pounds respectively. The figures for 1932 as compared with the returns for 1927 show an increase of 17% in the imports of Colonial tobacco, a decrease of 29% in imports from the U.S.A. and a reduction of 21% in the total importation of tobacco into the United Kingdom. The progress made by the Colonial product is of special significance in view of the downward trend of the total imports which have steadily receded since the year 1929 until last year, when the total imports had fallen by 64.7 million pounds. In comparison with the advance of Colonial tobacco the export of Southern Rhodesia tobacco to Great Britain has made considerable progress. The exports in 1928 totalled 10.2 million pounds, an increase of one million pounds over the previous year. In 1929 the exports decreased by 6.2 million pounds, followed the next year by a further drop of 0.4 million pounds, when the quantity exported amounted to 3.6 million pounds. In 1931 5.8 million pounds were exported, followed by a further rise in 1932, when the quantity reached a total of 10.4 million pounds. The reduction in the quantity of tobacco exported during the years 1929, 1930 and 1931 were due to the curtailment in production—a policy rendered necessary by the large surplus stocks of Southern Rhodesia tobacco which had accumulated in the United Kingdom during previous years. The policy of moderating the exports to Great Britain during a critical period lasting for three years, has led to the restoration of our exports to the level at which they stood in the year 1928. The percentages of Southern Rhodesia leaf to the total imports of Empire tobacco during the period 1927-1932 were 22.5; 23; 13; 10; 17 and 22 per cent. respectively, and in relation to the total of all tobaccos imported into Great Britain the percentages of Southern Rhodesia tobacco were 4; 5; 2; 2; 3 and 6 per cent. respectively.

There has been a corresponding expansion in the consumption of Colonial tobacco in the United Kingdom. The relative figures are shown in the following table:—


TOBACCO IMPORTS
UNITED KINGDOM
TOTAL
U.S.A.
TOTAL COLONIAL
S. RHODESIA
IN MILLION POUNDS (lbs)
YEARS
1927
1928
1929
1930
1931
1932
0
25
50
75
100
125
150
175
200
225
250


TOTAL CONSUMPTION U.K.
FOREIGN TOBACCO
COLONIAL
S.RHODESIA
IN MILLION POUNDS (lbs.)
YEARS
1927
1928
1929
1930
1931
1932
0
10
20
30
40
100
120
140
160
180

Consumption of Tobacco—United Kingdom.

Year.	Southern Rhodesia. lbs.	Total. Colonial. lbs.	Total Foreign. lbs.	Total Consumption lbs.
1927...	2,000,000	22,799,000	114,205,000	137,004,000
1928...	4,095,000	26,632,000	111,269,000	137,903,000
1929...	5,067,000	28,598,000	113,398,000	141,910,000
1930...	5,322,000	29,818,000	121,887,000	151,699,000
1931...	6,262,000	32,781,000	117,756,000	150,537,000
1932...	7,871,000	36,970,000	112,733,000	149,703,000

The total consumption increased from 137 million pounds in 1927 to 151.6 million pounds in 1930, since when it has fallen to 149.7 million pounds in 1932. The consumption of Colonial tobacco has on the other hand steadily risen from 22.7 million pounds in 1927 to 36.9 million pounds in 1932, whilst the foreign product rose from 114.2 million pounds in 1927 to 121.8 million pounds in 1930, and then declined to 112.7 million pounds in 1932. The consumption of Colonial tobacco in relation to total consumption during 1927 to 1932 may be expressed in percentages as follows:—14.7; 16.6; 17.1; 17.2; 19.1 and 21.6 per cent. Thirteen years ago the consumption of Colonial tobacco was only one per cent. of the total. The consumption of Southern Rhodesia tobacco has steadily increased from 2 million pounds in 1927 to 7.8 million pounds in 1932, or an increase of 294 per cent. in six years. During the same period the consumption of Colonial tobacco increased by 62 per cent., and the total consumption by 9 per cent. The consumption of Colonial tobacco, and more particularly the Southern Rhodesia product has, therefore, progressed at a steadily increasing rate. This has been most pronounced during the last two years when, in spite of a general downward trend in the total consumption, that of Empire tobacco has not only continued to increase, but the rate of increase has accelerated. The main factors to which might be ascribed the increasing use of Colonial tobacco are: (1) The financial depression and its inevitable reaction in stimulating the demand for cheaper smokes, which in turn increases the call for Colonial tobacco retailed at a lower price than the non-preferential tobacco. (2) The extending dimensions of the "Buy Empire" movement stimulated by the propaganda emanating principally from the Empire Marketing Board and

augmented by the efforts made by the organisations of the various Governments and private concerns having at heart the welfare of the British Empire. (3) The merit of the tobacco itself. An ever increasing number of smokers are being added to the ranks of Empire tobacco consumers because they prefer this tobacco to any other. The improvement in the general standard of quality of Colonial leaf has certainly much to do with its increasing popularity. (4) A substantially reduced crop in the United States of America last year increased the farm value of tobacco by 50 per cent. approximately. The increase in the value of American leaf plus the monetary exchange in favour of Colonial leaf has, aided by the Imperial Preference, been responsible for a marked increase in the consumption of Empire tobacco in the United Kingdom. It must be fully realised that any reduction in the cost of foreign tobacco naturally tends to decrease the full benefit which would otherwise be enjoyed by the Colonial product, and therefore tends to minimise the incentive towards the use of Empire tobacco in the United Kingdom. It would, however, be inadvisable to rely entirely upon the artificial aids at present combined and providing a stimulus in increasing the use of Colonial tobacco. Rather, every effort should be made to consolidate the position now gained in order that further expansion may be established upon a sound basis.

The tobacco industry of the British Empire is, to a greater or lesser degree, being built up on a basis of preferential tariffs, of which the Imperial Preference granted by the United Kingdom affords a notable example. The latter has been of tremendous benefit to the tobacco industry of Southern Rhodesia, and it may be stated that the progress made would not have been the same without the advantages of this preferential tariff. There is, however, a distinct danger in the Preference if it is not more fully recognised that this is purely an artificial aid. The industry must use the Preference as a means of attaining a measure of independence and arrive at the stage when it could, if necessary, dispense entirely with the Preference and continue to meet successfully the competition of the open market. There is a tendency, sometimes, to regard the Imperial Preference as a permanent institution which, without any other auxiliary efforts, is not only sufficient

for the present but which will also prove an adequate medium in the establishment and maintenance of all future expansion and progress.

The main problem before the tobacco industry to-day may be summed up in one word—Marketing. There are many fundamental problems with which the industry is faced which are very closely associated with and, in fact, the majority owe their origin to the complex nature of modern market requirements. The requirements of markets individually are not necessarily identical nor are they constant in all respects; rather, there is a tendency towards diversity in the classes of tobacco and fluctuation in the demand for each specific class of leaf. It follows, therefore, that the special requirements of each market calls for very close study on the part of the tobacco producers. This in turn necessitates the development of special types or classes of tobacco and thus are other problems introduced. The growers have to deal with problems relative to the cultural side and the manufacturers those problems which are associated with the manufacturing side of the industry.

It will be evident, therefore, that it is to their mutual advantage that the grower and the manufacturer should co-ordinate, to the greatest degree possible, their respective activities and so provide for the demands of the consumer. Although the consumer remains the final judge and arbiter, the manufacturer has the opportunity of influencing public taste and developing it along any desired lines. Fashions in smoking are subject to changes just as, for instance, fashions in clothes. The change, however, is neither so rapid nor, perhaps, so revolutionary as in the case of sartorial fashions of modern times. From this point of view the most outstanding change which has taken place during the last half century has been the extraordinary rise, growth,, and present popularity of the cigarette, at the expense of the other and longer established forms of smoking. There exists a certain measure of uncertainty as to whom belongs the credit for inventing the cigarette. It is claimed, however, that in 1798, during Napoleon's Egyptian Campaign, the big communal pipe belonging to Suleiman Bey's artillerymen was destroyed by a French shot. One of the Turks longing for a smoke, was

inspired to roll some tobacco in a piece of fine paper used for making gunpowder spills for the cannon. He thus made the first cigarette. Its prototype, of course, being the ancient Mexican reed cigarette and the maize husk variety also used in early times. In England the cigarette was made first in 1851 by R. P. Gloag and was developed by several Greeks and Russians, who made cigarettes from Oriental tobacco, and opened shops in London. The first shop was opened in Leicester Square in 1861 by a Greek, John Theodoridi. There were no cigarette making machines in those days, and the only cigarettes procurable were hand-made. The cigarette habit did not attain instant popularity, and they were chiefly smoked by foreigners. Some of the earlier brands were packed in elaborate and costly containers which added considerably to the cost of the cigarettes themselves and tended to curtail the demand. The first advance in cigarette smoking came with the introduction of machinery about the year 1878. From the time of the arrival of Carolina leaf, about 50 years ago, from which so-called Virginia cigarettes are manufactured, may also be said to date the commencement of cigarette smoking in the United Kingdom, on a small scale at first, all being of necessity, hand made. But when machines were invented and perfected, which made it possible to produce cigarettes at a much lower price than formerly, the trade at once began to increase by leaps and bounds, until it has now reached the gigantic proportions of the present day. Cigarettes have long since ceased to be regarded as boy's smokes and are now smoked by the millions.

In the United Kingdom the consumption of cigarettes in 1924 represented some 60 per cent. of the total consumption, whilst in 1930 it was over 74 per cent. of the total consumption. The total output of manufactured tobacco in the United Kingdom in 1930 was greater by 27 per cent. than in 1924 and there was an increase of 52 per cent. in cigarette consumption. The number of cigarettes consumed in 1929 was 42,598,680,000 and in 1930 45,898,982,000 cigarettes were smoked (an increase of 52% over 1924). The total cigarette production in 1929 amounted to 53,412,714,000 cigarettes.

U.S.A. Cigars.—The cigar industry started in Germany, where the first factory was established in 1793, at Hamburg.

During the large immigration to America from Germany in the period from 1870-1880 a considerable number of German cigar makers settled in the United States. These immigrants were both farmers and makers of cigars. Large colonies of the immigrants from the Fatherland settled in Pennsylvania and at once set about their chosen vocations—agriculture and cigar manufacturing. Full use was made by them of the knowledge they had acquired in Germany in the manufacture of cigars, as well as in the growing of tobacco. Thus the business of manufacturing cigars for the New World soon was transferred from Germany to the United States. About 1898 there began a general evolutionary movement towards mass production. In 1914 the cigar business went through a tremendous revolution. Machines were invented and perfected which made cigars in great quantities and at much less manufacturing cost than had been the hand-made article. The very character of cigars has undergone a change during this period of time. Prohibition has had a very marked effect on the public taste. The cigars to-day are very much milder than were the cigars which were produced during the period when it was legal to sell liquors. For forty years before 1905 cigar production increased steadily from 693 million to 7,748 million. Since 1905, however, cigar smoking has undergone vicissitudes, until the trend to-day is one of genuine concern.

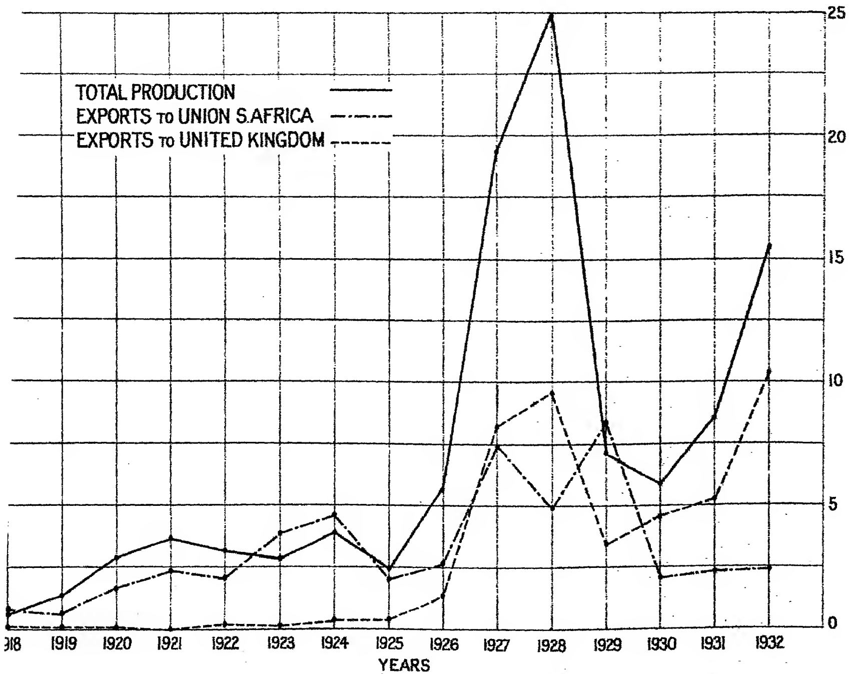
U.S.A. Cigarettes.—Beginning in 1902 the cigarette industry picked itself out of a slough and succeeded to an increasing wave of popularity. No single reason may be ascribed to account for this change in smoking habits. The younger generations have stronger preference for cigarettes than cigars. Cigarettes may have been preferred for any one of the following reasons:—Machine made product has appealed to a larger group on account of its lower unit price. Consistent and aggressive advertising may have broken down prejudices against cigarette smoking, long associated as an effeminate smoke. The World War gave additional impetus to cigarette consumption. Progress of the industry in the United States has been very considerable, the total output of cigarettes in 1901 amounted to 2,277 million, and each succeeding year showed an increase until the peak was reached in 1930, when 123,810 million cigarettes were manufactured.

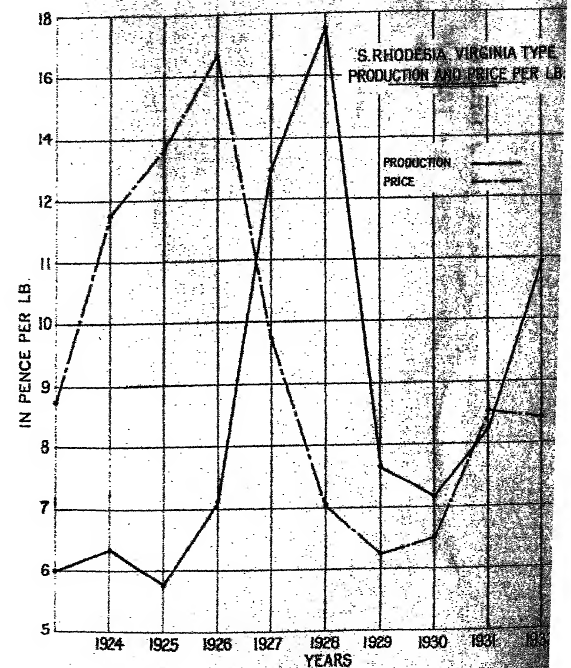
The total output for 1931 was 113,449 million cigarettes. In 1932 the United States consumed 102,000 million cigarettes. The phenomenal development of the cigarette industry instanced in the case of the United Kingdom and the United States will serve to illustrate the trend of cigarette smoking which is now universally popular. The areas where the cigarette type of tobacco can be produced are comparatively limited, and the present trend in the cigarette trade augurs well for the future of those countries which possess the requisite conditions for the production of bright cigarette tobacco. The enormous strides in cigarette consumption is of special significance to Southern Rhodesia, where soil and climatic conditions are suitable for the production of cigarette leaf.

SOUTHERN RHODESIA.

Cultural Distribution.—The distribution of tobacco producing centres throughout the Colony has been subject to alteration since the tobacco boom in 1928. Shortly before the latter year tobacco was being grown in 27 different districts within the borders of Southern Rhodesia. After the tobacco slump, cultivation in many districts was drastically curtailed or ceased entirely, leaving only those which had been the premier producing centres for a considerable period before the year 1928. The present distribution, speaking generally, is almost the same as it was in 1926, the main centres being located in the north and north-western districts of the Colony.

Production.—Since 1910 tobacco has been produced on a commercial scale, and until the year 1917 the yield fluctuated between one half million pounds to three million pounds. In 1918 the output was 1.5 million pounds, followed by a decrease to 620 thousand pounds in 1919. In 1920 the yield was 2 million pounds, and from the latter figure the harvests for successive years, including 1925, were 3.7 million pounds, 3.1 million pounds, 2.8 million pounds, 3.8 million pounds, and 2.4 million pounds respectively. A phenomenal increase in production took effect during the next three years, the output being 5.6 million pounds in 1926; 19.2 million pounds in 1927 and 24.9 million pounds in 1928. In 1929 the yield decreased to 7 million pounds, followed by a further drop to


TOTAL PRODUCTION
EXPORTS TO UNION S.AFRICA
EXPORTS TO UNITED KINGDOM
25
20
15
10
5
0
1918
1919
1920
1921
1922
1923
1924
1925
1926
1927
1928
1929
1930
1931
1932
YEARS


S.RHODESIA. VIRGINIA TYPE
PRODUCTION AND PRICE PER LB.
PRODUCTION
PRICE
IN PENCE PER LB.
18
16
14
12
11
10
9
8
7
6
5
1924
1925
1926
1927
1928
1929
1930
1931
YEARS

5.8 million pounds in 1930. Production in 1931 totalled 8.5 million pounds. In 1932 there was a substantial increase to 15.1 million pounds. The average price per pound realised by the producers of the flue cured tobacco has fluctuated considerably from season to season.

Season.	Flue cured pence per lb.	Dark Fired pence per lb.
1923	8.75	Note.—No crop planted but experimentally before 1927.
1924	11.75	
1925	13.73	
1926	16.61	
1927	9.72	9.0
1928	7.04	8.5
1929	6.29	9.0
1930	6.50	9.0
1931	8.50	10.0
1932	8.40	8.8
Average 1923-27	12.11	—
Do. 1928-32	7.34	9.06

The price of the flue cured type of tobacco during the years 1929, 1930 and 1931 are rough estimates only, no accurate returns being available owing to the disorganised state of the market. The dark fire cured tobacco prices are all estimates, no accurate returns being available for the entire crop sold each year. It is interesting to compare the local prices with those obtained by the American and Canadian tobacco growers.

	Flue Cured.			Dark Fire Cured.		
	Southern Rhodesia.	Canada.	U.S.A.	Southern Rhodesia.	Canada.	U.S.A.
1927...	9.72	17.0	10.65	9.0	11.5	6.3
1928...	7.04	15.5	8.85	8.5	9.5	6.35
1929...	6.29	14.5	8.95	9.0	9.5	6.35
1930...	6.50	16.0	6.00	9.0	7.0	4.1
1931...	8.50	10.5	4.50	10.0	6.0	2.5
Average per lb. ...	7.6d.	14.7d.	7.7d.	9.1d.	8.7d.	5.12d.

It will be noted that the returns to the tobacco growers in Southern Rhodesia are, in the case of flue cured leaf, practically the same as the average price received by American growers and about 50 per cent. less than the average price of Canadian tobacco. For the dark fire cured type there is little difference between the price received by both the Southern

Rhodesia and Canadian tobacco growers, whilst the American average for this particular type of leaf is approximately 45 per cent. lower than the Rhodesian average.

From information available it would appear that the downward trend in the value of Canadian flue cured and dark fire cured tobacco continued in 1932, the average price being estimated at 8d. per lb. and 4d. per lb. respectively.

In America the majority of tobacco growers are reported to be rather pessimistic concerning the outlook for tobacco. Many of them have lost money growing tobacco during the past three or four years, and the low price received for their crop in 1932 did not pay the fertiliser cost in many instances, much less the labour cost in producing the crop.

Principal Markets for Southern Rhodesia Tobacco.—The principal markets for Southern Rhodesia tobacco at the present time are the United Kingdom, the Union of South Africa and Portuguese East Africa. Others of lesser significance are Northern Rhodesia, Belgian Congo, Kenya, Holland, Finland, Germany, Australia, Norway and India.

Exports from Southern Rhodesia during the period 1928 to 1932 have been distributed as follows:—In 1928 to British countries, 98.6 per cent. (United Kingdom 65.3 per cent., Union of South Africa 33.2 per cent.), foreign countries 1.4 per cent.; in 1929, 98.5 per cent. British (U.K. 28.2 per cent., Union 70.2 per cent.), foreign 1.4 per cent.; in 1930, British countries 96.7 per cent. (U.K. 66.2 per cent., Union 29.6 per cent.), foreign countries 3.3 per cent.; in 1931, British countries 96.3 per cent. (U.K. 66.7 per cent., Union 29.4 per cent.), foreign countries 3.6 per cent.; and in 1932, 99.1 per cent. to British countries (U.K. 76.8 per cent., Union of South Africa 17.7 per cent., other countries 4.6 per cent.), foreign 0.8 per cent. It will be noted that our exports to the United Kingdom have increased to a far greater extent than any of the other markets indicated. The exports to the Union of South Africa during the year 1929 were unduly increased owing to the stimulation of exports in anticipation of some alteration in the Customs Agreement and the probable imposition of an Import Duty. The market for Southern Rhodesia tobacco in the Union of South Africa has now become diminished and

ranks second in order of importance. Portuguese East Africa ranks third as an outlet for Southern Rhodesia tobacco. The type of leaf in demand is generally low grade suitable for manufacture of pipe mixtures and cigarettes, consumed both by the Portuguese and by natives. The existing market has grown spontaneously and there is undoubtedly an opportunity for the further development of this market, which possesses great potentialities. The extension of the demand for low grade tobacco is essential in the interests of the industry, and owing to the low value of this class of tobacco, all existing markets contiguous to Southern Rhodesia should first be concentrated upon. The exploration of other outlets, further afield, for low grade tobacco should be proceeded with purely as a supplementary measure and not in opposition to the development of existing markets adjacent to Southern Rhodesia. The Belgian Congo consumes the same class of leaf as is used in Portuguese East Africa, and as an outlet for Southern Rhodesia tobacco warrants further development.

The production of tobacco in countries such as Uganda, Kenya and Tanganyika is increasing gradually, and probably will, in time, preclude the possibility of developing any extensive demand for our product in competition with the locally produced commodity. Pending this eventuality, however, it would be advisable to consider the establishment of Southern Rhodesia tobacco in these countries. Nyasaland and Northern Rhodesia do not present any great potentialities as markets for our tobacco.

The Continental markets (Germany, Holland, Finland, Norway, Sweden, France and Italy, etc.) can only be developed on a strictly competitive basis and, for the immediate future, at all events, can therefore be regarded only as possible outlets for surplus stocks in the case of emergency. There is a general tendency for the majority of the foregoing countries to increase the production of tobacco within their own territory—a policy which is already tending to react somewhat unfavourably against the import of certain types of tobacco which previously constituted the bulk of their domestic requirements. The development of the Continental markets for Southern Rhodesia tobacco would become increasingly difficult as the American product is gradually replaced by

Colonial tobacco in the United Kingdom. Competition on Continental markets would increase in direct proportion to the rate at which the American tobacco was eliminated from the United Kingdom. The American exporters would have to redouble their efforts to maintain and extend to the utmost the Continental markets for their exportable surplus stocks of tobacco in an endeavour to offset any decrease sustained in exports to the United Kingdom. In the event of the establishment of intra Empire trade there would be no immediate necessity for the export of Southern Rhodesia tobacco to the Continent. There are certain Dominions and Colonies within the British Empire which annually import substantial quantities of American tobacco and may, therefore, be regarded as potential markets for the Southern Rhodesia product. These markets have not been systematically tested and surveyed with a view to establishing a demand for Southern Rhodesia tobacco.

Great Britain, already our most important market, possesses also the greatest potentialities. There are almost unlimited possibilities in regard to this market for Southern Rhodesia Bright flue cured leaf suitable for cigarettes. It is estimated that of the total quantity of Colonial tobacco manufactured in the United Kingdom approximately 10 per cent. goes into cigarettes, whereas roughly 75 per cent. of the total imports is used for cigarette manufacture at the present time. The total domestic sale of cigarettes in the United Kingdom in 1930 was 1,220 per capita and approximately 90 per cent. of the tobacco used in these cigarettes was grown in the United States of America. Before the Great War three times as much tobacco was consumed in pipes as in cigarettes. Cigarette consumption in Great Britain is now leading in the ratio of four to one.

The respective consumption of Colonial and foreign tobaccos in the United Kingdom may be expressed in percentages approximately as follows:—1924, pipe tobacco, 22 per cent. Colonial, 78 per cent. foreign; cigarettes, Colonial, nil, 100 per cent. foreign; 1927, pipe tobacco, 37 per cent. Colonial, 63 per cent. foreign; cigarettes, 1 per cent. Colonial, 99 per cent. foreign; 1932, pipe tobacco, 65 per cent. Colonial,

35 per cent. foreign; cigarettes, 10 per cent. Colonial, 90 per cent. foreign. It is a significant fact that since the inception of the Empire Marketing Board in 1926 there has been a very substantial increase in the consumption of Colonial tobacco. It is evident that in the cigarette market there is the greatest room for expansion, and this is of particular significance to Southern Rhodesia, because this Colony is essentially a cigarette tobacco producing country, soil and climatic conditions being favourable for the cultivation of this type of leaf. Our chief competitors in this field are America and Canada. The demand for Dark Fire Cured tobacco is, comparatively speaking, limited and the market is supplied largely with the native grown product of Nyasaland. The effect of the competition engendered by this native grown tobacco is now apparent in Southern Rhodesia. Through the same cause also has the demand for Canadian Dark Fire Cured tobacco become greatly diminished in the United Kingdom. Nyasaland, Uganda and India with their native tobacco production and low costs can undersell the Southern Rhodesia product, and in all probability will eventually dominate the market. There has been a serious decline in demand for Southern Rhodesia Dark Fire Cured leaf, and the producers of this type of tobacco are in difficulties. The alternative to complete stagnation rests in the development of new markets or in the production of some other type of tobacco suited to the soil and climatic conditions obtaining in the present Dark Fire cured areas. Small experimental lots of Sun and Air cured tobacco are now being tried out, and if proved successful then there will be a general change over from the Dark Fire cured type.

The production of the Turkish type of tobacco in this Colony has remained fairly constant for a number of years. Since the limitation of exports to the Union of South Africa it has been found necessary to market the surplus in Great Britain. The demand for this type of tobacco on the latter market, however, is very limited. In the future development of the export trade in this type of tobacco it may be necessary to regard the potentialities afforded by Continental and other foreign markets in addition to the possible demand which may exist or which may be fostered in the United Kingdom and in other units of the British Empire. The maximum con-

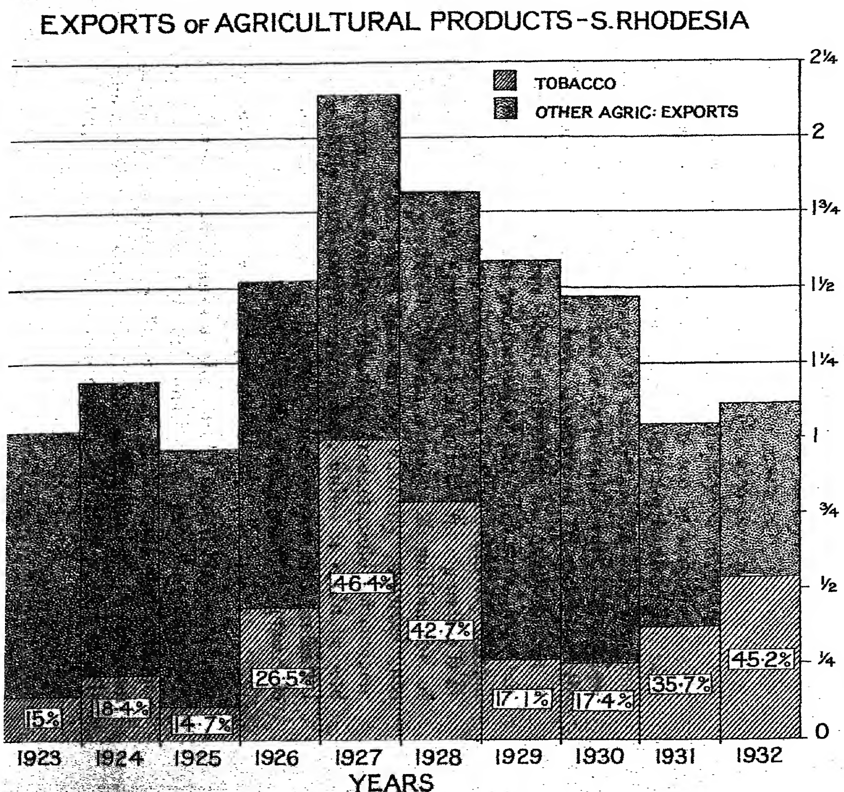
sumption of Turkish tobacco in the United Kingdom has been estimated at approximately 5 million pounds per annum. The present level of consumption is considerably below this figure. Southern Rhodesia and the Union of South Africa are the only countries producing the Turkish type leaf on any significant scale within the British Empire. Neither of these two countries have made any appreciable efforts to foster the market in Great Britain until quite recently—all previous efforts having been devoted almost exclusively to the Virginia type of tobacco. The production of the Turkish type in the Union of South Africa and in Southern Rhodesia is roughly 1,200,000 lbs. and 500,000 lbs. respectively. In Southern Rhodesia production has been regulated in accordance with the existing market demand. If any further outlets are found then production could be increased accordingly. The relative value of the tobacco exports to the total value of agricultural crops exported from Southern Rhodesia is epitomised in the following table and indicates clearly the economic importance of this crop:—

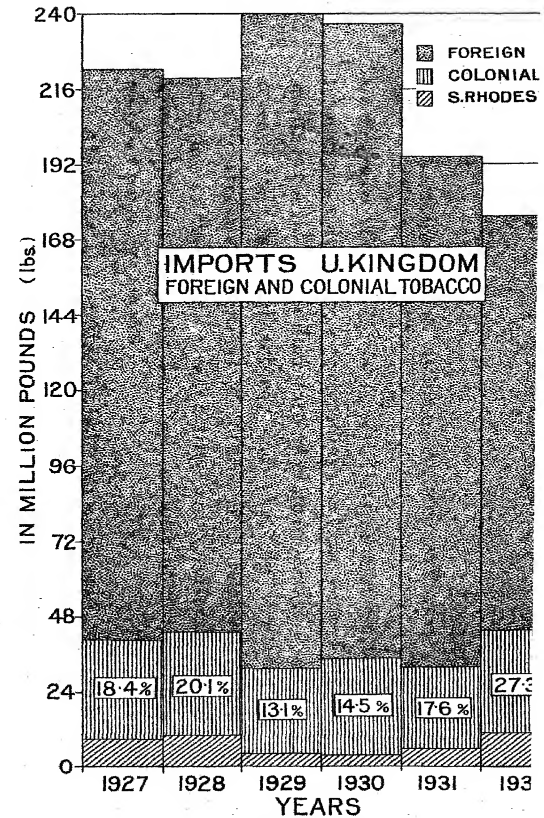
Exports—Agricultural Products.

Year.	Total Crops. Value. £	Tobacco. Value. £	Tobacco. Value. Per cent.
1923	1,029,680	154,030	15.0
1924	1,177,160	216,526	18.4
1925	963,402	141,234	14.7
1926	1,524,541	404,276	26.5
1927	2,143,117	994,899	46.4
1928	1,824,357	779,474	42.7
1929	1,588,561	271,428	17.1
1930	1,472,497	255,683	17.4
1931	1,049,294	374,544	35.7
1932	1,213,474	548,199	45.2

Potential Markets for Southern Rhodesia Tobacco.

Australia.—In order to develop the Australian tobacco industry a substantial protection has been afforded by the Australian Government. This led to a minor boom in 1931-32, with the result that tobacco has been grown in many unsuitable areas and considerable quantities of leaf unsuitable for marketing has been produced. The yield in 1931-1932 was approximately 10 million pounds, whilst the average production over the previous ten years was roughly two million pounds of leaf.





Drawn and Photo Lithographed at the Surveyor General's Office.

On February 26th, 1932, the Import Duty on unmanufactured tobacco was reduced from five shillings and two pence to three shillings per lb. for the dual purpose of guaranteeing a certain revenue from imported tobacco and checking the trend of greatly increased plantings of tobacco with relatively little attention to the question of quality, which certainly would have continued under the high rate of duty of five shillings and two pence per pound.

About the end of March, 1932, an agreement was made between the Federal Government and the Australian tobacco manufacturers for the purchase of at least 7,200,000 lbs. of that season's crop, at an average price of two shillings and three pence per pound; at the end of November the quantity of leaf purchased at two shillings and three pence per lb. had exceeded the stipulated amount by 600 thousand pounds. A further half million pounds of lower grade leaf had also been purchased. The largest company had also promised to buy a further one million pounds at an average price of two shillings and three pence per pound, so that it can be anticipated that the total purchases at this figure would not be less than nine million pounds. The system of marketing the local crop has been either by public auction or by private treaty. The prices at auction sales ranged from sixpence to 48 pence per lb. Although tobacco has been cultivated in Australia for a number of years, the production of the Flue cured type has not yet attained any great success. Only a relatively limited quantity of Bright Flue cured leaf suitable for cigarettes is at present being produced. On an average, 20 million lbs. of American Flue cured tobacco are annually imported into Australia. The Southern Rhodesia product could not compete successfully with the American leaf, unless it could be sold at a competitive price or through the allowance of a prefential rebate. The possibility of the latter being granted appears to be somewhat remote at the present time.

India.—India ranks as the world's second largest tobacco producing country, but the quality is predominately low grade. India produces 28 per cent. of the total world production and 90 per cent of total Colonial tobacco. The production in 1931 totalled 1,281 million pounds, of which approximately

30 million pounds were exported; 80 per cent. of India's tobacco exports are consumed in the Empire. Successful efforts are now being made in the production of Bright Flue cured leaf, and a large increase in the output of this type is to be expected. The rate of increase is uncertain, but it will be some time before production equals the local demand. The average annual import of American Bright Flue cured tobacco is roughly three million pounds. The consumption of cigarettes is rapidly increasing.

British Malaya and Ceylon.—Also import fair quantities of American Flue cured tobacco. British Malaya has recently introduced a preference on British cigarettes, the rebate amounting to fivepence per lb.

Palestine, Malta and Cyprus.—These countries do not import very considerable quantities of American Flue cured and Dark Fire cured tobacco as compared with many other of the British Colonies and Possessions, but they would nevertheless prove useful markets for our Bright Flue cured and Dark Fire cured tobacco if suitable trade arrangements could be effected. These markets are nearer to our production centre than many of the other overseas markets to which tobacco has already been exported from Southern Rhodesia. Cyprus allowed a preferential rebate of one-sixth of the general tariff in 1931.

West African Markets.—The Gold Coast, Nigeria, Sierra Leone and Gambia import principally the Dark Fire cured and Dark Virginia types of tobacco; they would be very useful markets for our Dark Fire cured leaf if suitable shipping facilities were made to provide for direct shipment. The introduction of a preferential tariff should be of material assistance in establishing our product on these markets in competition with the American types now in the monopoly. Sierre Leone has, since the Imperial Economic Conference held at Ottawa, granted a preference of 4d. per lb., and Gambia allows a preference of 3d. per lb. The Gold Coast has a non-preferential tariff, because of the Anglo-French Convention of 1898. Nigeria also allows no preferential rebate on Colonial tobacco imports.

Irish Free State.—Considerable quantities of Bright Flue cured and Dark Fire cured tobacco are consumed in the Irish Free State. The bulk of this tobacco is of American origin, and we could not compete successfully unless some reciprocal trade agreement were made. The transportation costs on American tobacco exported to Ireland are considerably lower than the cost of transporting tobacco from Southern Rhodesia to the latter country.

Canada.—Canada herself produces considerable quantities of tobacco. The crop output in 1921 amounted to 13 and one-quarter million pounds and increased to 51 and one-quarter million pounds in 1931. Exports to the United Kingdom during 1932 amounted to over nine million pounds, which represents a considerable increase over the previous year and three times as much as was exported in 1930. The price received in 1930 by the Canadian flue cured tobacco producers averaged 16d. per lb. and 10.5d. in 1931. The production of this type of leaf was 24 million lbs. in 1931 compared with 12 and one-third million lbs. in 1930. Climatic conditions are uncertain in practically all the tobacco growing areas in Canada, and it is not anticipated that the same rate of progress can be maintained as is possible in other and more favourably situated Dominions and Colonies. Both the yield and quality of the Canadian crop are therefore liable to a greater degree of fluctuation than obtains normally in the majority of tobacco producing countries. The influence of unfavourable seasonal conditions may possibly tend to reduce exports from Canada in certain seasons, but from the present trend in production it seems improbable that the necessity will arise for importing other Colonial Flue cured leaf into Canada in the near future. The policy of the Canadian Government is towards the elimination of tobacco imports and to increase the consumption of the domestic product. The imports of American Flue cured tobacco amount to approximately 13 million pounds annually. The question of exporting Southern Rhodesian Flue cured tobacco to Canada should, however, be fully investigated in order to ascertain whether our product could possibly be used instead of the foreign product now being purchased. The introduction of a Preference or some other form of reciprocity would be a necessary encouragement. The

Canadian market should prove a useful outlet for Southern Rhodesia Turkish type of leaf, as this class of tobacco is not grown in that country.

Kenya, Uganda, Tanganyika.—These countries are producing tobacco on a gradually increasing scale, and it is therefore unlikely that any extensive demand will be created for Southern Rhodesia tobacco. Local production has not yet overtaken domestic consumption, and consequently there is an opportunity for establishing our product on these markets until such time as the East African tobacco production has been considerably increased.

It will be noted that the foregoing discussion has been confined to the potentialities of certain markets within the British Commonwealth. Reference having already been made in regard to the possibilities of exporting Southern Rhodesia tobacco to foreign countries.

Before an export trade could be satisfactorily developed in the majority of these overseas markets it would be necessary to make thorough investigations regarding the exact requirements of the markets concerned. A systematic survey could best be made by those who have the requisite knowledge of tobacco and are competent to study the manufacturers requirements. There is a difference in the flavour of Southern Rhodesia Flue cured tobacco as compared with the American product. This factor has been the main cause militating against a more general and greater use of Southern Rhodesia and Colonial tobacco in the United Kingdom, the same applies to these tobaccos when competing with the American leaf in Europe and other markets. Our American competitors have naturally emphasised the fact that Colonial Flue cured tobacco is different from the American leaf, and that the former is only a substitute. There is no doubt that the difference in taste has been unduly stressed and exaggerated, but the effects of this propaganda are apparent and the superstition is still present in popular opinion. The introduction of the blended cigarette has, to a large extent, overcome this difficulty and will progressively increase the consumption of Southern Rhodesia Flue cured tobacco. The consumers are being gradually educated to the flavour of our product and all will eventually

acquire a taste for the 100 per cent. Rhodesian cigarette. The prejudice against Colonial tobacco is already diminishing and will eventually die out altogether. The Imperial Preferential Tariff has proved useful in extending the consumption of Southern Rhodesia tobacco in Great Britain and would undoubtedly yield a similar result in regard to the marketing of our product in the majority of British Dominions, Colonies and Possessions.

Trade enquiries for Southern Rhodesia tobacco have recently been received from countries such as Norway, Sweden, Denmark, Spain, The Irish Free State, and India, and there is a possibility that some of our leaf tobacco will be purchased by them during the course of the next few months. It is not known exactly what will be the effect on our exports to those countries as a result of America's departure from the Gold Standard. All trade enquiries having been received here prior to the abandonment of the Gold Standard by the United States.

The system of marketing Southern Rhodesia tobacco has changed periodically and the methods adopted have included sale by public auction, private treaty, sealed tender and by contract. In 1910 the auction system was introduced after sale by private treaty had proved disappointing. Owing to disagreement between the sellers and the buyers the auctions were discontinued in the year 1914. Resulting from the failure of the public auction system, the Rhodesia Tobacco Co-operative Society (registered) was formed to undertake the warehousing and marketing of the crop. After the year 1918 this Society sold under contract to the two leading manufacturing firms in the Union of South Africa. The contracts covering a period of three years and with optional extension of the period and prices ranging between 3 shillings and sevenpence per lb. to threepence per lb. according to the grade of leaf. In 1923 the Rhodesian Tobacco Co-operative Society (reg.) was liquidated and the Rhodesia Tobacco Warehouse and Export Co., Ltd., was formed and took over all assets and liabilities of the old Society. During the year 1926 the Rhodesia Tobacco Warehouse and Export Co., Ltd. exported fairly large quantities of tobacco to the United Kingdom, and in 1927 allowed their contracts with the Union manufacturers to

lapse, with one exception, and at the same time instituted sales locally by sealed tender, and, later, by private treaty. Marketing by sealed tender was a failure.

The year 1928 saw the re-introduction of public auction sales, but this method was discontinued after the second sale. The system of selling by private treaty has become more firmly established since 1927, when a warehouse was erected by the Imperial Tobacco Co. (of Great Britain and Ireland), Ltd., and further since the increase in the number of tobacco buyers who are now operating in this Colony. Marketing in the Union of South Africa became considerably altered in 1930, when the latter country introduced a quota allowing a duty free import of 2 million pounds Virginia type of and 400 thousand pounds Turkish tobacco from Southern Rhodesia. The Southern Rhodesia Tobacco Control Board, afterwards re-named the Southern Rhodesia Tobacco Board, was formed to administer the Union quota and also the sale of tobacco required for manufacture by local firms. The method of selling tobacco for overseas markets is by private treaty. The leaf is either sold locally and then exported by the purchaser, or else the grower exports direct and effects a sale through agents established in the country where the tobacco is marketed. This system has proved fairly satisfactory under existing circumstances, but it is open to question as to whether it will remain so indefinitely. It is yet uncertain whether the public auction system will become a permanent feature in the local marketing of our crop. During the period when there were no overseas buyers visiting this Colony and local buyers were few in number the possibilities of successfully introducing auction sales were remote. The number of tobacco buyers now regularly visiting Southern Rhodesia would remove any objection on this score, and it seems that the question of the re-introduction of this system might well be considered by all those interested in the tobacco industry of this Colony. The fact that selling by public auction has already been tried on several occasions and met with failure does not necessarily mean that a similar fate would attend this method of sale under the altered conditions now existing.

Future Development.—The economic importance of the tobacco industry, although already of considerable significance in the economy of Southern Rhodesia, will become greatly enhanced through future development, the rate of progress being dependent upon the success attending the efforts of the growers in providing an article which conforms to the standard required by the manufacturers and governed also by the expansion of present markets and the development of others. The growth of the industry is not a simple expansion, but rather there is throughout a tendency towards specialisation, and progress is dependent upon the development of specific types of leaf for which there must be a definite and well recognised demand. The evolution of well defined types due to the influence of soil and climatic conditions has been in progress ever since tobacco became established in the Colony, and this natural process is being further aided by elimination of unsuitable varieties and types by the growers themselves.

The closer study of the special requirements of each market and the supplying of requisite types and qualities will tend to establish an increasing demand for Southern Rhodesia tobacco on existing and potential markets.

There is evident a tendency for the various interests concerned in the tobacco industry to get together with the object of introducing a greater measure of co-ordinated effort into their industry. This is essential, for in the more scientific economy of the future, an industry to be efficient, will need to be organised on a wide basis and not left to haphazard production and improvident endeavour.

Other industries have been learning this lesson, and in the tobacco industry there is still ample scope for improvement. In the co-ordination of all interests rests the future of the tobacco industry, and attendant upon the measure of co-operation is there the corresponding degree of success.

Our motto might, therefore, well be: "Progress to learn —Learn to progress."

Report of the Chief Entomologist

FOR THE YEAR ENDING 31ST DECEMBER, 1932.

By RUPERT W. JACK.

AGRICULTURAL.

Pests of crops have continued to receive inadequate attention throughout the year under review. This is chiefly due to administrative duties necessitated by the various activities of the Branch and the demands of pests of livestock, including tsetse fly, which absorbed the major portion of the time of the entomologists.

One entomologist has, however, been able to devote his attention largely to the study of pests of stored tobacco and, in addition, to the Tobacco White Fly (Fam. *Aleyrodidae*) which is responsible for the transmission of a serious virus disease of growing tobacco, to which the name " Leaf Curl " is now usually applied.

The most serious pest of stored tobacco from the commercial standpoint is the moth known as *Ephestia elutella*, Hbn. This insect shows a predilection for the bright and medium grades of Virginian tobacco, and also attacks Turkish leaf freely. Its occurrence in the Colony, at least as a pest of tobacco, is now apparently confined to the vicinity of a factory in Salisbury, to which a considerable quantity of tobacco has been imported from the Cape Province, where the pest is known to have been troublesome for many years.

The insect does not appear to do a great deal of direct damage at Salisbury, and there is reason to suspect that it does not increase as rapidly in our climate as it does under more humid conditions near the South African coast, and in Great Britain.

Fortunately, methods of destroying the insects in the bales have been tested by the Imperial College of Science and Technology in London with satisfactory results, whilst effec-

tive measures have been adopted in Southern Rhodesia to ensure that exporting warehouses are kept free from the pest. The main factor which makes this pest of particular importance to Southern Rhodesia appears to be the predilection of the insect for the types of tobacco which are mainly produced in and exported from the Colony, rather than environmental conditions in the Colony itself.

"Leaf Curl" is a disease which is assuming considerable importance to the tobacco industry in the Colony, and legislation is contemplated with a view to enforcing measures for the suppression of its vector, Tobacco White Fly.

A new and locally serious pest of maize, namely, the Melolonthid, *Eulepida mashona*, Arrow, has been studied by another member of the entomological staff during the year. The larvæ of this beetle have done a great deal of damage to maize in certain parts of the Victoria District. These larvæ are typical "white grubs," many species of which are serious pests in different parts of the world. This is, however, the only species which has so far been recorded as a major pest of maize in Southern Rhodesia. The same species is also recorded as having inflicted heavy loss on a crop of ground nuts in the Salisbury district some years ago (1928).

The usual pests of all crops have been prevalent at the commencement of the present season and notes on these are included below.

The annual toll which insects take from the crops in this Colony is far higher than is generally realised, and it is unfortunate that circumstances at present do not admit of more attention being devoted to research with a view to better control. An annual average loss of 25 per cent. to the maize crop through insect attack alone is a conservative estimate, and many maize growers estimate their losses at a considerably higher figure.

The end of the year has found the entomological staff engaged in organising a campaign against the offspring of large swarms of locusts of two different species, which invaded the Colony during November and December.

LOCUSTS.

First Invasion: September-October. — *Locusta migratoria migratorioides*, Rch. and Frm.—Swarms of this species commenced to invade the Colony from the north-east late in September and continued to fly in a south-westerly direction, apparently leaving the Colony by the end of October. The direction appeared to be controlled by the strong N.E. winds which occur during the spring. It is estimated that 20 to 30 swarms were involved. The ovaries of all specimens examined proved to be only partly developed, and no eggs were known to have been laid. The food most commonly taken consisted of young grass, but winter maize was also devoured to some extent. Some forest trees were defoliated, including Msasa (*Brachystegia randii*, Bak., F.).

Second Invasion: November-December. —*Nomadacris septemfasciata*, Serv.—In late November and early December, swarms of the Red Locust were reported from the Wankie District. It was hoped at first that the occurrence was merely a repetition of the behaviour of this species during December of the previous two years when swarms passed over the western corner of the Colony into Bechuanaland. However, the swarms took an easterly to south-easterly direction, penetrating the Colony, whilst further swarms entered from the north, and later apparently from Portuguese Territory. By the end of December most districts had been invaded and egg laying had become fairly general. Many acres of maize have been damaged, but in most cases not sufficiently to destroy the plants. Tobacco, in the main, has been left undamaged. Eggs had not hatched by the end of the year. Small Dipterous parasites have emerged from adults of several swarms.

Locusta migratoria migratorioides, Rch. and Frm.—Co-incident with the invasion of the Red Locust, Tropical Migratory Locust swarms entered the Darwin district from the north in early December. Eggs were laid almost immediately and hoppers have appeared. The species is reported only from some of the north-eastern districts. A few swarms consisting of both species were reported.

Pests of Cereals. —The maize stalk borer (*Busseola fusca*, Full.). The main emergence of the first generation of moths

at Salisbury occurred from the 6th to 15th December. The snout beetle (*Tanymecus destructor*, Mshll.) caused considerable damage to maize crops in December. White grubs (*Eulepida mashona*, Per.) caused much damage to maize plants in the Victoria District by attacking the roots. The pest is being studied, and considerable information accumulated. The wheat mite (*Penthalens destructor*, Tuck.) severely damaged late sown winter wheat in the Gutu district in August. The mite has not previously been regarded as of economic importance in this Colony. Its increase is probably due to lack of regular rotations and of adequate working of the land.

Pests of Tobacco.—Root Gallworm (*Heterodera marioni*, (Cornu, 1879) Goodey, 1932). The rotation experiments in connection with this pest are continuing.

Tobacco Whitefly (Fam. *Aleyrodidæ*). A sudden increase in the amount of "frenching" led to an investigation being made in co-operation with the Plant Pathologist, and the so-called "frenching" proved to be a virus disease known as "leaf-curl" carried by this insect. Observations to date indicate that volunteer tobacco plants growing during the winter and spring months are mainly responsible for the persistence of leaf-curl and whitefly on tobacco farms. Other pests of importance included:—(1) Tobacco aphis (*Myzus persicæ*, Sulz.) on Turkish tobacco; (2) Ants carrying off germinating seedlings from seed-beds; (3) Cutworms, especially *Euxoa segetum*, Schiff, in seed-beds; (4) An unidentified Noctuid caterpillar with habits somewhat similar to those of cutworms in seed-beds; (5) Stem-borer (*Phthorimæa heliopa*, Lw.), and (6) Wireworm (*Trachynotus*, sp.).

Pests of Cotton.—Cotton Bollworm (*Heliothis obsoleta*, F.) damaged crops to the usual extent, especially in the early setting varieties. The Sudan bollworm (*Diparopsis castanea*, Hmps.), a less important pest, caused considerable damage early in January. Stainers (*Dysdercus nigrofaciatus*, Stal. and *D. intermedius*, Dist.) were very abundant.

The dusky cotton stainer (*Oxycarenus*, sp.) was very abundant on half-open bolls.

Pests of Citrus.—Citrus thrips (*Scirtothrips aurantii*, Faure) was only of moderate intensity and effective control was obtained by spraying with lime sulphur. Damage by aphis (*Aphis tavaresi*, del.G.) was very slight. The attack of the cotton bollworm (*Heliothis obsoleta*, F.) at Mazoe was probably the heaviest ever experienced there, and the pest was also unusually troublesome in the Umtali district. This information has been obtained through the courtesy of the officers of the B.S.A. Company's Citrus Experimental Station at Mazoe.

Pests of Stored Products.—The known distribution of the stored tobacco worm (*Ephestia elutella*, Hubn.) has been limited to a cigarette factory in Salisbury. Scrupulous cleanliness and complete and early disposal of crops have apparently prevented its spread. These methods eliminated the pest from the warehouse mentioned in last year's report. The same methods are effective against the tobacco beetle (*Lasioderma serricorne*, F.) which is now practically unknown in tobacco warehouses.

Observations during the last two years have shown that fully grown larvæ of various ages pupated *en masse* in August-September and adults appeared in September-October.

New or Noteworthy Records of Pests.—(1) *Lygæus militaris*, Fabr. damaged peaches in various localities by attacking the ripening fruit; (2) Chafer Beetles and fruit beetles, including *Anomala*, spp., *Adoretus*, spp., and *Pachnoda*, spp. damaged the leaves and fruit of deciduous fruit trees; (3) *Macrosiphoniella sanborni*, Gill (Aphidæ) was noted as a pest of chrysanthemums in Salisbury from January to March; (4) *Ceroplastes helichrys sinoiæ*, Hall (Coccidæ) on young Jacaranda trees in Salisbury; (5) *Eriococcus aurantia*, Mask. on Norfolk Island pine in Salisbury; (6) *Inglisia geranii*, Brain (Coccidæ) on geranium in Bulawayo in October and November; (7) *Epimadiza hirta*, Mall. (Chloropidæ) very abundant during September and October in stems of gladiolus in Bulawayo, Gwelo and Salisbury; (8) *Togocephala wahlbergi*, Fhrs. (Cerambycidæ) boring in stems of hibiscus in Matopos in October and November; (9) *Apate monachus*, F. (Bostrychidæ) adults boring in living ornamental and fruit trees in various districts in October, being particularly

serious in *Trichilia emetica* under cultivation in the Salisbury district; (10) *Gonocephalum simplex*, F. (Tenebrionidæ) attacking young seedling wheat and barley in Salisbury; (11) the slug caterpillar (*Parasa vivida*, Wlk.) damaging coffee trees, was largely controlled by its Braconid parasite, *Fornicia africana*, Wilk. in Rusape.

MEDICAL AND VETERINARY.

Tsetse Fly; General Remarks.

The struggle with the Tsetse Fly menace has continued unabated throughout the year. Operations against game have been intensified in certain districts, notably the Hartley district, and a forest clearance experiment has been inaugurated on the Melsetter border.

Organisation. —Some necessary reorganisation of the control of these operations has been brought about during the year. The process has involved trial of an unsatisfactory arrangement and its final abandonment in favour of something of a more practical nature.

During nearly six months of the year control of the operations was nominally divorced from the Entomological Branch, although in practice the branch was not relieved in any way of either work or responsibility. The Entomological officers co-operated in complete harmony with the administrative officer, to whom direction of the operations had been handed over, but the dual control proved unworkable, and it is satisfactory to be in a position to report that at the end of the year a more suitable arrangement is in operation. Under this arrangement an Entomological officer is in direct control of the operations, under the general direction of the Chief Entomologist, and is assisted by an administrative officer of the rank of Assistant Native Commissioner seconded temporarily from the Native Department.

Game Reduction. –The destruction of game involved in these operations has led to criticism in various quarters, and is in fact regretted by all concerned. It is an emergency measure which has been forced on the Colony, in the absence

of feasible alternatives, by the unremitting tendency of the tsetse fly (*Glossina morsitans*) to spread towards its former, presumably climatic, limits. The former range of tsetse fly in Southern Rhodesia is known to cover an area of approximately half the Colony and, providing that the wild animals on which the fly feeds are sufficiently abundant, reinfestation of practically the whole of this area is not only a possibility but to be anticipated as the natural course of events.

The game reduction cordon completed round the limits of the fly area in 1929, with the exception of a short section between the Shangani and Zambesi rivers in the west, appears to be achieving its general object of preventing further spread of fly. In place of the former necessity of recording substantial encroachment of the pest each year it is satisfactory to be able to state that there has been no record of a really definite advance during the past two years, again with the exception of the small section mentioned above, where it has so far not proved feasible to undertake effective operations. Slight variations in the fly limit may have occurred elsewhere. In this connection it is perhaps desirable to point out that isolated outbreaks of trypanosomiasis in new localities do not necessarily indicate definite extension of the fly infested area. It is probable, however, that some country of no value for either European or native agriculture may still need to be surrendered in one or two districts, an effective cordon being only possible further back where the terrain affords more suitable conditions, *e.g.*, Urungwe Native Reserve in the Lomagundi district, and the lower Gwaai River in the Wankie district.

In sections where an attempt is being made, not only to check the spread of the fly, but to drive it back from settlement, definite success has been achieved in the Lomagundi (Umboe) section, the position in Lomagundi South-West remains satisfactory and, in the difficult section included in the Gatooma sub-district, the fly is definitely receding and there are indications that the position in certain parts of the occupied area is improving. Much, however, remains to be achieved in the Gatooma section. The operations in the Wankie area have not been in progress for a sufficient length of time for reliable results to be apparent by the present date.

Open Areas.—A decision has been reached during the year to close all the present "open shooting areas," except those in more or less occupied and easily accessible country immediately behind the zones of the government operations. The necessary Government Notice should be published almost immediately. It is considered that this is a wise decision, as "open shooting areas" at any considerable distance from settlement have to date invariably failed to achieve their object.

Forest Clearance.—The forest clearance experiment on the Melsetter border is a welcome change from the game reduction operations elsewhere, particularly as it has not so far involved destruction of any considerable number of trees of fine growth. The clearing has been rendered feasible by the limited distribution of the forest in this region, grassland, rather than forest, constituting the dominant vegetation along the section involved in the clearing. The effect of the clearing in regard to preventing incursions of *Glossina pallidipes*, Aust., and possibly *G. brevipalpis*, Newst. from Portuguese Territory is, of course, uncertain and developments during the present wet season are awaited with interest.

Traffic Control.—Cleansing of traffic has been enforced in the various localities reported below, and a considerable number of tsetse flies have been collected off vehicles, cyclists and pedestrians at certain stations.

At other stations the number of flies collected hardly appears to warrant continued maintenance of the station, but it is to be pointed out that changes are liable to occur without warning in the volume of traffic and the routes traversed in the tsetse fly country, particularly in connection with prospecting and mining. The stations, therefore, constitute safeguards against such occurrences, which might otherwise constitute serious threats to farmers in the localities concerned. The station on the Sinoia-Copper Queen road is an example of such a station.

General Position.—With regard to the tsetse fly position generally it can be stated that *Glossina morsitans*, which is the only species present in the northern part of the Colony, is apparently being brought under control in so far as con-

finement to some twenty thousand odd square miles of country, mostly of inferior quality, is concerned. It is to be realised, however, that not only does its presence in this area constitute a serious handicap to native development but certain areas of considerable value for ranching purposes are involved, as well as some agricultural land. Further spread of the pest, of course, threatens occupied areas of much greater agricultural importance.

The position in the south-east of the Colony is such as to cause some disquietude on account of the apparent tendency of various species of tsetse fly to spread in Portuguese Territory, involving possible eventual invasion of the low veld in and to the south of the Melsetter district. It is to be noted that the Sabi, Lundi and Limpopo valleys in the low veld in Southern Rhodesia were infested with tsetse fly during the past century.

Tsetse Fly Traps.—Tsetse fly traps of the Harris type and somewhat similar patterns have been exposed on an experimental basis in various fly infested districts throughout the year. The results are similar to those previously obtained, namely, that any considerable catch has only occurred during a small portion of the year, and even then has been too small to afford promise of practical benefit from the use of the traps.

A number of different designs of traps have now been tested without sufficient improvement in results. The whole data collected and records obtained from elsewhere have been carefully studied.

Analysis of available data suggests that the reason for the failure of these traps in Southern Rhodesia lies deeper than details of design—that it lies, in fact, with the principle itself. There are considerable differences in habits and reactions beween *morsitans* and *pallidipes*, and such differences as are known, from observations recorded in various parts of Africa, would appear sufficient to account for the failure of the traps against *morsitans*, under climatic conditions in this Colony. Arguments in this connection have been elaborated in a paper which it is hoped to publish at an early date.

Research.—It is greatly regretted that it has not been possible to pursue any form of tsetse fly research during the year with the exception of the experiments with the traps.

1. *Operations, Lomagundi (Umboe).*—With the exception of one localised outbreak of trypanosomiasis involving about eight head of cattle, no cases of the disease have been reported from this district during the year.

Fly is only now to be met with within a distance of about four (4) miles south of the northernmost game fence, and even there the density is very low, *i.e.*, less than one fly per hour, except quite close to the fence where it is slightly higher. The position in this district was dealt with in an article in the November number of *The Rhodesia Agricultural Journal.*

So marked is the reduction of "fly" over the whole of this area that an extension of the operations northwards to the escarpment is contemplated. A preliminary "fly" survey will be made in this connection early in the coming year. By extending the operations some 15 to 20 miles northward to the escarpment it should be possible to consolidate the ground already recovered in this district. The farms which are to-day in the danger zone should be freed from the danger of stray "fly" and some good agricultural land reclaimed for settlement.

2. *Operations, Lomagundi S.W.*—Owing to financial reasons no new fences were constructed in this area during the year. An isolated outbreak of trypanosomiasis involving some twelve head of cattle occurred on a farm situated close to the main footpath leading from the Magondi Reserve and two relapse cases occurred on a farm previously subject to heavy losses. A temporary cleansing chamber was erected on the native footpath mentioned but was closed down after being in operation for several months, no flies having been seen on this route. Density counts indicate that no change has taken place in the general distribution of "fly" in the area. A pocket of "fly" persists around Gwinzoma Hill and generally along the Umfuli and Umniati Rivers and their tributaries. The improvement mentioned in last year's report has been maintained.

3. *Operations, Gatooma District.*—Experience elsewhere having clearly indicated that a ten mile game free buffer zone was not wide enough to produce satisfactory results from game elimination operations, a decision was taken during the year to extend the operations ten miles west of the present western fence. Financial considerations have, however, prevented the erection of another game fence. The number of native hunters has been doubled to cope with the increased area being shot over. Large game is now very scarce inside the fenced area, but the number of game destroyed over the whole area remains fairly high owing to the fact that the area of operations covers a considerable area outside the fences.

Density counts taken inside the fenced area indicate further retrogression and general diminution in the density of "fly" inside the fenced zone; by extending the operations westward it is hoped that this retrogression will be accelerated.

Two farms mentioned in last year's report, as being subject to heavy losses from trypanosomiasis, have been abandoned during the year. The general position on all other farms in this area is, however, definitely better than in any previous year since 1926. There were 24 deaths (including eleven Government oxen from the inoculation camp) from animal trypanosomiasis in this district during the year compared with 67 in 1931. Some of the decrease is due to the fact that no cattle have been on Carfax Estate since August, 1931. Nevertheless a decided improvement has occurred on Rhodesian Plantations and other farms in the district.

This district has been a free shooting area since 1905, but during the present year the area has been closed to free shooting and a limited and restrictive system of shooting by permit has been substituted.

4. *Operations, Wankie District.*—No improvement in the position can as yet be reported for this area. The greater part of the settlement along the Gwaai River formed to act as a barrier against the advancing "fly" still remains very definitely with the zone of established "fly" or within the danger zone.

There has been an increase in the number of cases in this area due to several factors. In the first place it has been the previous experience that flies tend to range further afield for a period when game reduction operations are undertaken. Secondly, farmers for reasons of drought or influenced by a too optimistic faith in antimony injection have moved cattle into the danger zone. Thirdly, natives have moved their cattle closer to the fly against warning. Fourthly, the fly seems to be spreading down the Gwaai River beyond the limits of the operations and possibly to a small extent up the Shangani.

In spite of the intensified operations game is still reported abundant in most parts of this area. The scarcity of water away from the Gwaai and Shangani rivers has caused an influx of game into the area, including some elephant from the Game Reserve, six of the latter being shot by the settlers and native hunters.

There has been some reduction in the very high densities of "fly" recorded last year between the Gwaai and Shangani rivers and a definite decrease in numbers is recorded along the Gwaai River and the Bulawayo-Victoria Falls Road.

Free hunting in this area is now only permitted by special permit and is limited to the area west of the Shangani River. Permits are obtainable from the Ranger in charge on application. This closing of the open shooting area was necessitated owing to the difficulty of controlling motor traffic, to prevent poaching outside the open area and to concentrate all shooting operations close to the settlement.

Operations under Control of the Native Department.

(*a*) *Sebungwe.*—These operations were closed down in September as it was felt that they were doing little good, the area being too large. Further, it was considered that the Mafungabusi Plateau in itself possibly constituted a natural barrier against any further encroachment of fly on to the plateau. A few cases of trypanosomiasis have occurred in the vicinity of the Native Commissioner's station, on Sikombella Farm and around Sidoma Peak.

(*b*) *Shangani Reserve.*—Operations against game were continued throughout the year under the supervision of the Assistant Native Commissioner.

Efficient control of the native hunters has been established, following the appointment of a native messenger and the native hunters have been re-distributed in accordance with the present distribution of "fly." Some 200 head of native cattle have died in this area, presumably mostly from trypanosomiasis, and deaths are still occurring. A slight extension of the "fly" area up to the Shangani River is thought to have taken place, "fly" having been caught at Lukasa's and Magodi's kraals some twelve miles above the junction of the Tchangokwe and Shangani Rivers. Native owned cattle have, however, been moved considerably nearer the fly area during the past two years.

(*c*) *Urungwe.*—Operations under the control of the Assisant Native Commissioner, Miami, have been continued and intensified during the year. A number of cases of trypanosomiasis have occurred on the eastern edge of the Urungwe Reserve, but no definite extension of the fly belt has been recorded. Owing to the closing of the Mica Fields the European population of this area has been considerably reduced.

(*d*) *Sipolilo.*—The improvement mentioned in previous annual reports has been maintained and a further area between the Impinge and Hunyani Rivers has been practically cleared of "fly." "Fly" is reported to have almost, if not entirely, vanished in the area south of the escarpment and east of the Dande River.

(*e*) *Darwin.*—A number of cases of trypanosomiasis were diagnosed on a group of farms close to Darwin camp during June, July and August. No permanent "fly" exists within twenty miles of these farms and the infection was probably due to flies carried in by motor or other traffic. Only very occasional flies are now located south of the escarpment and no permanent "fly" is known to exist there.

A few head of cattle are to be found in the south-eastern portion of the reserve, the remainder of the reserve is, how-

ever, still within the danger zone and all native owned stock have died or been removed. As long as the Zambesi Valley, north of the escarpment, is infested the northern portion of the reserve must always be subject to occasional invasion by carried or wandering fly.

MELSETTER.

Certain localised experimenal forest clearings have been created following an investigation made by the Chief Entomologist and the Senior Forest Officer. Two areas have been cleared of forest, one on the Busi River, intended to break the forest connection in the Busi Valley with the forest in Portuguese East Africa, the other on the Chibuzana River, a tributary of the Busi River, necessitated owing to a continuous bush connection through Bayswater Farm with dense forest across the border. In both cases about 1½ miles of bush in the river valleys have been cleared. Certain small subsidiary clearings making a continuous break have also been made on a number of farms along the elevated border.

It is not considered that permanent "fly" has as yet become established in this district, only one "fly" having at any time been taken on the Rhodesian side of the border. Two species of fly, *viz.*, *G. pallidipes* and *G. brevipalpis*, are known to occur in Portuguese Territory close to our border. Both species are generally associated with denser vegetation than *G. morsitans*.

The portion of the International border where the clearings have been made consists of an elevated crest of land ranging in altitude from 6,000 feet at Melsetter to 3,500 at Mt. Selinda. On the eastern side the land falls sharply away, very much in the nature of an escarpment, into Portuguese East Africa with an altitude of roughly 1,500 feet. A number of rivers penetrate the border, notably the Lusitu, the Buzi and the Umselezwe, their courses lying in deep and well wooded valleys forming a more or less well defined forest connection with the "fly" infested forest in P.E.A. Much of the border consists of open grass land with a few patches of open forest and occasional clumps of high type forest. Climatically the

conditions on the elevated border are probably unsuitable for fly and it is considered doubtful if "fly" actually crosses into Southern Rhodesia over these hills.

Both climatically and ecologically the conditions along the low lying valleys are typical of the conditions which occur in the main "fly" belts in Portuguese East Africa. It is along these rivers that "fly" most probably enters Southern Rhodesia, and the clearings are planned to break the forest connection.

The present experimental clearings are designed to protect the farms lying in the basin of the Buzi River. If successful further clearings may be attempted later on.

During the year a detailed fly reconnaissance of the border has been made and a census of the cattle in the district is being undertaken.

Fairly heavy losses of native owned stock from trypanosomiasis have occurred in the native purchase area below Chikore, but a careful survey failed to locate any "fly" in Portuguese East Africa close to the site of the outbreak.

TRAFFIC CONTROL.

Nine stations for the control of traffic of "fly" areas were in operation during the year. One temporary station in the Lomagundi South-West district was in operation for some eight months, but was closed down in September, no flies having been seen on traffic in the period. Two stations in the Darwin district are for pedestrian traffic only.

(*a*) *Tchetchenini Road: Lomagundi District.*—Forty-three (43) motor cars, 1,221 cyclists and several hundred pedestrians passed through the chamber. Only six flies (sex unknown) were taken off pedestrians. The southern fenced zone is now free from fly, hence the very few flies taken at this chamber, whilst most of the motor traffic does not go into known fly.

(*b*) *Miami-Zambesi Road.*—One hundred and ninety-nine (199) cars, 38 cyclists and several hundred pedestrians passed through the cleansing chamber. A total of 106 flies (65 male and 41 female) were taken by the guards, 59 flies (38 male

and 21 female) off cars and 47 flies (27 male and 20 female) off pedestrians. There has been a decrease in motor traffic during the year and fewer flies, 106 against 175, were taken off traffic.

(c) *Copper Queen Road.*—This road is now practically impassable for motor traffic and only 28 cars passed through during the year. Three hundred and ten (310) cyclists and 3,552 pedestrians passed through the chamber. Only 16 flies (12 male and 4 female) were taken during the year, 1 male fly off a car and 15 flies (11 male and 4 female) off cyclists and pedestrians. The chamber is situated a considerable distance from any tangible fly, probably twenty miles, which accounts for the very few flies taken at this chamber.

(d) *Robb's Drift Road: Gatooma District.*—There has been a decrease in the amount of motor traffic using this road, probably due to the closing of the open shooting area in August; there has also been a considerable decrease in the number of flies caught at the chamber. One hundred and seventy-seven (177) cars, 275 cyclists and several hundred pedestrians were treated in the chamber. A total of 377 flies (225 male, 145 female, plus 7 unknown) were caught, 271 flies (159 male and 112 female) off cars and 106 flies (66 male, 33 female and 7 unrecognisable) off cyclists and pedestrians.

In 1931, 687 flies were taken at this chamber.

(e) *Bulawayo-Victoria Falls Road*: (1) *No. 1. Dett Valley Chamber.*—Five hundred and seventy-three (573) cars, 78 cyclists and several hundred pedestrians passed through the chamber. A total of 336 flies (116 male and 230 female) were caught, 259 flies (84 male and 175 female) off cars and 77 flies (32 male and 45 female) off cyclists and pedestrians. The percentage of female flies, 68 per cent., is remarkably high.

In the previous year 230 flies were taken at this chamber. The number of motor vehicles passing through the chamber increased by 273 cars.

(2) *No. 2 Chamber: Farm 114 (?), 115.*—Six hundred and seventeen (617) cars and several hundred cyclists and pedestrians were treated at this chamber during the year, and 299 flies (157 male, 128 female, plus 14 unidentified) were taken by

the guards. Of these 226 flies (124 male and 102 female) were taken off cars and 73 flies (33 male, 26 female, plus 13 unidentified) off cyclists and pedestrians.

The number of motor vehicles passing through the chamber during the year increased by 334, while the number of flies caught increased by 171.

(3) *No. 3. Walker's Road Chamber.*—This chamber was erected on Walker's Road about a quarter of a mile above the junction with the main road for the purpose of preventing flies being carried down to the Gwaai Drift and distributed along the Gwaai River. It is the main route used by hunting parties and leads through heavily infested fly country. In August the road was closed to motor traffic because of the danger of flies being carried right through into the settlement.

Twenty-four (24) cars, and several hundred pedestrians passed through the chamber, the guards catching a total of 4,180 flies (2,770 male, 1,211 female, plus 199 unidentified). Of these, 699 flies (510 male and 189 female) were taken off cars, and 3,481 flies (2,260 male, 1,022 female, plus 199 unidentified) off pedestrians.

It is proposed to establish two more stations in this area, one to deal with traffic leading from the Gwaai Bridge to Kennedys, and one on the proposed new deviation of the main Bulawayo-Victoria Falls Road.

(*f*) *Darwin.*—The two cleansing chambers in this district deal only with pedestrian traffic coming over the Escarpment from the Zambesi Valley. These chambers are erected on the two main footpaths, the other footpaths being closed by regulation.

(1) *Masongerera's Path.*—Some 15,000 pedestrians passed through the chamber and a total of 100 flies (48 male, 33 female, plus 19 unidentified) were caught by the guards. This is one of the main footpaths used by Portuguese natives entering the territory.

(2) *Nyamarapara Path.*—Some 1,600 pedestrians passed through this chamber and 112 flies (56 male, 25 female, plus 31 unidentified) were caught by the guards.

Reconnaissance and Investigation.—An officer of the branch spent four months on the Eastern Border mapping the "fly" limits in Portuguese East Africa. No tsetse flies were actually found on the Rhodesian side of the border. Between the Buzi River and the Lusitu River flies were encountered within a mile or so of the border wherever suitable forest conditions existed. On the Lusitu River "fly" (*G. brevipalpis*) was found in some numbers on the Portuguese bank of the river, which there forms part of the International boundary.

Screw-worm Investigations.—Myiasis in cattle due to infestation of wounds with the maggots of the fly *Chrysomyia bezziana*, Vill., has continued to constitute a very serious factor adversely affecting the ranching industry, and there can be little doubt that it will continue to do so until better methods of control are developed and practised.

With the advent of the wet season an entomologist proceeded to Balla Balla to continue his study of this pest, and particularly to test the comparative efficiency of a number of larvicides and wound dressings. Some of these are already in common use, but a number of additional substances are also included in the plan of experiments.

Possibilities in reference to trapping the flies are also being investigated.

A great amount of further research is likely to prove necessary before this pest is brought under really satisfactory control. It is a problem which might advantageously absorb the energies of more than one entomologist.

Tick Survey.—In accordance with a suggestion from the Director of Agriculture a complete survey of the ticks infesting livestock throughout the Colony has been inaugurated with the co-operation of the Veterinary Department. To the end of the year nothing of importance has come to light; the material collected will be examined in more detail later.

ADMINISTRATION AND GENERAL.

Tobacco Pest Suppression Act, 1931.—As mentioned in last year's report this Act has not proved fully satisfactory in operation. Representations have also been made to the

Government to the effect that all tobacco farms in the Colony should be brought within the scope of the Act. Further representations have been made to the effect that legislation should be enacted making destruction of all growing tobacco by a certain date compulsory, this measure being considered necessary for the control of "White Fly." A new Act has, therefore, been drawn up embodying these recommendations and generally supplying the deficiencies of the previous measure.

Licences were granted in respect of fifty-seven (57) warehouses during the year. Except in a few justified cases, all these warehouses were inspected.

Importation of Plants Regulation Ordinance, 1904.—Comprehensive regulations based on the decisions of the Inter-State Conference on Plant Import Regulations held in August, 1931, were drawn up and published.

The following consignments have been dealt with by the Plant Inspectors at the various ports of entry during the year:—

Salisbury	1,729
Bulawayo	6,478
Plumtree	203
Umtali	583
Gwelo	435
Total	9,428

The plant import returns show a decrease of over 4,000 consignments compared with 1931, all records up to that year having shown a progressive increase.

Two hundred and one (201) Special Permits for the introduction of plants, etc., into the Colony were issued.

Sixty-nine (69) Annual Permits were granted to registered nurserymen in the Union of South Africa.

Regulations in Other Countries affecting Export of Plants from Southern Rhodesia.—Thirty-seven (37) certificates of cleanliness have been issued in respect of plants intended for export to other countries.

Injurious Substances and Animals Ordinance, 1909.—Seven (7) certificates for the importation of beeswax, two (2) for the importation of foundation comb, and two (2) for the importation of queen bees were granted during the year. One jar of honey was intercepted and destroyed by the Plant Inspector at Bulawayo.

Nurseries Ordinance, 1909.—An amendment to this Ordinance, *viz.*, the "Nurseries Ordinance Amendment Act, 1932," includes a new definition of "nursery stock" which admits of the growing of herbaceous plants for sale without the necessity of registration. Regulations in respect of fumigation of nursery stock have been made more comprehensive and up-to-date.

During the year thirty-two (32) nurseries were registered under the Ordinance and forty-six (46) were inspected.

Lectures.—Four (4) lectures on " Ticks " were delivered to the B.S.A. Police, and one short lecture to a Farmers' Association.

Farms Visited.—Seventy-three (73) farms were visited during the year, excluding those visited on tobacco warehouse inspection duties, and advice given by members of the staff.

Agricultural Show.—An entomological exhibit was placed on the Agricultural Show at Salisbury with two officers of the Branch in attendance.

Papers Published.—Apart from various contributions to the daily press, mainly in regard to locusts, the following papers were published during the year:—

"The Lesser Tobacco Wire-worms," by R. W. Jack, in the *Rhodesia Agricultural Journal* for March (reprint illustrated).

"Pests of Stored Tobacco in Southern Rhodesia," by M. C. Mossop, M.Sc., in the *Rhodesia Agricultural Journal* for for April (illustrated).

"Notes on the Habits of Some Diptera in Rhodesia," by Alexander Cuthbertson, in the *Proceedings of the Rhodesia Scientific Association,* Volume XXXI.

"Cultural Methods and Tobacco Whitefly in Southern Rhodesia," by M. C. Mossop, M.Sc., in the *Rhodesia Agricultural Journal* for November.

"Tsetse Fly Operations in Lomagundi District (Umboe and Sipolilo Areas)," by R. W. Jack, in the *Rhodesia Agricultural Journal* for November (two maps).

Identification of Insects.—During the year more than a thousand specimens, comprising over three hundred and seven (307) species, were submitted to specialists in Southern Africa and abroad for study. Ninety-seven (97) species were identified by the Imperial Institute of Entomology and the British Museum (Natural History), fifty-six (56) by American Museums, forty-three (43) by Dr. Hall, Director, B.S.A. Company's Citrus Experimental Station at Mazoe, and sixteen (16) by museums and other institutions in Southern Africa. Thus a total of two hundred and twelve (212) identifications, including a number of new species, has been obtained.

Staff.—The staff of the branch has been augmented during the year by the addition of the Administrative Officer, Tsetse Fly Operations, and extra temporary assistance provided for the purposes of the locust campaign. At the end of the year it consists of the following officers, namely:—four (4) technical officers, one (1) whole time Plant Inspector, one (1) administrative officer, one (1) laboratory assistant, two (2) clerk-typists, five (5) rangers, two (2) assistant rangers, and one (1) tsetse fly inspector, whilst authority has been granted for the appointment of an additional ranger.

The year has been a strenuous one for the headquarters staff, and this has only been accentuated by the locust invasion.

I desire to testify to the loyal manner in which all these officers have responded to the calls made upon them, calls which, in connection with the locust campaign, have necessitated general disregard of both office hours and official holidays.

The temporary officers of the field staff, with one exception, have also rendered satisfactory service.

I desire further to express my appreciation of the way in which officers of other Departments and other Divisions of the Department of Agriculture have co-operated and assisted. In this connection I would particularly mention the Native Department in reference to both Tsetse Fly Operations and the Locust Campaign.

Aloe Thraskii.

Aloe transvaalensis.

Aloe arborescens.

Notes on African Aloes.

By H. Basil Christian, Ewanrigg, Arcturus.

PART X.

Aloe Thraskii.—*A. Thraskii* is one of the arborescent aloes and is confined to the South Coast of Natal. With its gracefully recurved deeply channeled leaves having a short row of prickles on the keel towards the apex, and its branched inflorescence with dense racemes of bright yellow flowers tipped with green, and its filaments much exserted, it is easily recognised. It thrives under Southern Rhodesian conditions, grows quickly and flowers in May and June.

Description.—Arborescent. Leaves rosulate, lanceolate acuminate, up to 75 cm. long, 14 cm. broad low down and 13 mm. thick in the middle, light green, slightly glaucous with a short row of prickles on the keel towards the apex, sometimes with a second row on one side near the margin; margin with deltoid cuspidate, brown, horny prickles 2mm. long, 15-20 mm. apart, interspaces straight. Inflorescence a terminal branched raceme; peduncle stout, branches clothed with scariose, many-nerved ovate-acute, empty bracts, 6 mm. long and 9 mm. broad; raceme very dense, up to 15 cm. long; pedicels very short; floral bracts imbricate, scariose, ovate acute 3-nerved, 7mm. long and 9 mm. broad; flowers bright yellow shading to green at the apex, deflexed but slightly upturned towards the apex; perianth 16 mm. long, 6 mm. dia. at the base, swollen to 13 mm. towards the middle on the one axis and laterally compressed to 9 mm. on the other, slightly constricted towards the throat; tube very short; inner segments white with 3-nerved yellowish green median line shading to green at the apex; stamens much exserted, 15 mm. long, included portion greenish yellow, exserted portion golden yellow; anthers terracotta; style greenish yellow, slightly shorter than the stamens; after fertilisation, the stamens are withdrawn into the perianth, the style remaining exserted.

Aloe Arborescens.—*A. arborescens*, in its different varieties, is widely distributed, being recorded from Mossel Bay, Natal, Zululand, the Transvaal and Southern Rhodesia, where it occurs at the Victoria Falls, Inyanga, Umtali, and Melsetter. There are several named varieties, and as Mr. Neville Pillans, of the Bolus Herbarium, is making a special study of aloe, it ought not to be long before we know more about the rather numerous varieties if, as is hoped, he will publish a monograph on the subject.

It is a very showy aloe with its mass of red flower spikes, and as the different varieties flower at different times, the earliest flowering variety being in flower at Ewanrigg in February and the lates in July, it will be seen that it is possible to have specimens in flower for half the year.

Description.—An arborescent branched shrub. Leaves up to 60 cm. long, 7 cm. broad at the base and 12 mm. thick in the middle, gradually tapering to the apex, slightly falcate, nearly flat or slightly concave, on the upper surface, convex on the lower surface, pale green, very slightly glaucous; margins armed with deltoid, white tipped horny prickles curved forwards, 4 mm. long and about 12 mm. apart below, 18 mm. apart above, interspaces straight. Inflorescence one or more from each rosette of leaves, simple or branched. Peduncle laterally compressed below, cylindric above with about 12 reddish, membranous, many nerved, empty bracts; 12 mm. long and 9 mm. broad. Floral bracts oblong, membranous, many nerved. Pedicels 26 mm. long on lower flowers. Raceme dense, conical, up to 21 cm. long. Young flowers erect-spreading, lower flowers pendulous. Perianth 45 mm. long; outer segments red, paler on the inner surface, inner segments white with a distinct red midrib, not showing through to the inner surface, shading to green at the apex. Stamens as long as the perianth or exserted, pale yellow; anthers reddish-brown; style exserted, yellow ovary 8 mm. long, 3 mm. dia., cylindric.

Aloe Transvaalensis O. Ktze.—*A. Transvaalensis* is one of the acaulescent spotted leaf aloes and was first recorded from the dolomite formation at Irene, near Pretoria. What is believed to be a variety of this species occurs near Lobatsi,

Bechuanaland, but up to the present *A. Transvaalensis* has not been recorded from Southern Rhodesia. Plants, received from Pretoria, have, so far, shown no signs of suckering, whereas the Lobatsi variety increases by means of underground runners throwing up plants at a distance from the parent. It does well under Southern Rhodesian conditions and flowers at Ewanrigg in March.

Description.—Acaulescent. Leaves rosulate, strap shaped short, more or less 4 times as long as broad, 12 to 25 cm. long, acute or sub-obtuse, not acuminate, spinoso-dentate, the teeth towards the base of the leaves 5 mm. long, divaricate, equal, with sub-erect hard tips, glabrous, smooth above, pallidly spotted, flat.

Scape more or less 1.0 m. high, pyramidaly paniculate, not flexuous, branches up to 5, easily racemous, 10 to 20 flowered, the lower up to 20 cm. long, with narrow very acuminate bracts more or less 1 cm. long.

Pedicels solitary or up to 3 crowded, rather longer than the bracts, sub-erect.

Lateral flowers erect or sub incurved, up to 3 cm. long with acute segments, spreading, base and apex more or less 5 mm. broad, middle part 2-3 mm. broad.

Stamens not as long as segments and not exserted.

Locust Invasion, 1933.

SOUTHERN RHODESIA.

Monthly Report No. 6, May, 1933.

1. **Nomandacris septemfasciata.**—Winged swarms of this species continue to move about in various directions, practically the whole of the Colony being included in these movements.

The flights are not of a definitely migrationary character but a general westerly drift is apparent, notwithstanding the fact that some easterly movements are also recorded.

There may be some tendency for the swarms to leave the dry low veld for the higher ground. Large swarms have appeared in the humid zone close to the eastern border where no hoppers occurred. There appears to be a tendency for swarms to continue haunting certain localities in this zone flying around without any definite direction. The higher parts of the Melsetter district, including the Chipinga sub-district, are thus affected.

The flight of the swarms is generally low and characterised by much settling, the swarms tending to "roll" along over the ground and not to fly high above it.

Development of red pigment on the head and pronotum of the insects has been noted during the month, and at the end of the month there were indications of the pink suffusion at the base of the hind wings, although this had attained only a very small fraction of its full development.

2. **Locusta migratoria migratorioides.**—There has been no record of this species in the Colony during the month.

Eggs have been laid by caged specimens from the first week of the month, but no hatching has as yet taken place.

3. **Feeding.**—Whereas the hoppers of both species confined their attention more or less to *Gramineous* crops, the winged swarms have attacked a wide variety of plants, including tobacco, but the type of feeding suggests that latterly the object has been moisture more than food. This phase has followed a period of voracious feeding immediately after the attainment of maturity.

4. **Parasites and Disease.**—No disease has been discerned amongst the swarms, and parasites noted have been limited to one Dipterous larva, (unidentified) and a number of instances of infestation with thread worm.

5. **Enemies.**—Apart from natives who are collecting the locusts for consumption whenever possible, enemies have not been much in evidence.

6. **Destruction of Hoppers.**—The campaign came to an end early in the month.

7. **Damage to Crops.**—Injury to European grown crops reported has been limited to a comparatively few small patches of winter grain during the earlier part of the month. The grain in most cases was young and is growing again.

Late Kaffir millet is reported to have been destroyed by winged swarms in some areas.

RUPERT W. JACK,
Chief Entomologist.

Southern Rhodesia Veterinary Report.

APRIL, 1933.

AFRICAN COAST FEVER.

Melsetter.—No mortality at any of the existing centres

GALLSICKNESS OF CATTLE.

More prevalent than usual in various districts.

SNOTZIEKTE IN CATTLE.

Twenty-two deaths reported from the Chilimanzi district.

HORSE-SICKNESS.

Ten deaths reported.

IMPORTATIONS.

Nil.

EXPORTATIONS.

Beef in cold storage to the United Kingdom: Hindquarters, 3,733 lbs.; fore-quarters,, 3,667 lbs.; livers, 7,031 lbs.; tongues, 3,741 lbs.; hearts, 3,017 lbs.; tails, 2,527 lbs.; skirts, 1,605 lbs.; shanks, 187 lbs.; kidneys, 66 lbs.

Southern Rhodesia Weather Bureau.

MAY, 1933.

Pressure.—Barometric pressure was generally above normal in Southern Rhodesia.

Southerly lows were prevalent on the South Coast and were succeeded by good highs. Early in the month the lows showed no tendency to travel up the South-east Coast, but in the latter half of the month each successive low came further North until the 25th, when one passed through the Mocambique Channel, causing extremely low pressure in Rhodesia.

The highs in the early part of the month came up the East Coast, but when the lows began moving up the coast, the highs approached across the Kalahari, bringing cold weather to Matabeleland.

Temperature.—Mean maximum temperatures were above normal except in the Midlands. Mean minimum temperatures were generally below normal by one or two degrees. A cold spell was experienced from the 25th to 27th, especially in Matabeleland, where freezing temperatures were recorded in the screens at some stations.

Rainfall.—Apart from a little orographic rain or drizzle on the Eastern Border and in South Mashonaland, there was no rain worth mentioning.

MAY, 1933.

Station.	Pressure Millibars, 8.30 a.m.		Temperature in Stevenson Screen °F.								Rel. Hum.	Dew Point	Cloud Amt.	Precipitation.			Altitude (Feet)
			Absolute.		Mean.												
	Mean.	Normal.	Max.	Min.	Max.	Min.	½ Max. Min.	Normal.	Dry Bulb.	Wet Bulb.	%	F.	0-10	Ins.	Normal	No. of Days	
Bulawayo	872.8	871.5	81	34	74.8	47.6	61.2	61.1	61.0	51.2	50	42	1.2	...	.26	...	4,436
Gwelo	866.1	...	80	33	74.5	46.4	60.5	60.8	59.4	50.9	55	43	1.4	...	.02	...	4,638
Riverbank...	...	...	89	35	80.7	48.0	64.3	62.6	59.3	51.4	58	45	...	...	.02	...	4,100
Essexvale	...	...	91	34	83.2	43.9	63.5	62.0	53.0	48.4	72	45	...	...	.01	...	3,828
Gwanda	910.4	...	85	30	77.4	45.6	61.5	...	61.0	52.8	57	45	1.2	...	.06	...	3,235
Mazunga	953.4	952.6	89	32	81.5	45.7	63.6	65.1	64.7	55.5	56	48	1.5	.05	.01	1	1,970
Nuanetsi	...	...	90	32	81.7	51.9	66.8	...	62.0	56.3	70	52	2.3	...	.11	...	1,630
Enkeldoorn	861.3	...	80	35	73.7	45.3	59.5	60.9	61.0	53.2	60	47	1.1	...	.03	...	4,820
Gatooma	...	...	85	39	79.4	45.5	62.4	64.2	58.5	51.2	60	45	1.2	...	.01	...	3,850
Miami	882.6	...	80	43	75.5	49.0	62.3	...	63.3	55.6	62	50	1.6	...	.02	...	4,090
Salisbury	858.2	858.1	79	39	74.4	45.9	60.1	61.0	61.9	52.6	52	44	1.3	...	.02	...	4,890
Sinoia	891.7	...	85	38	79.2	42.8	61.0	...	62.9	54.5	58	48	0.5	...	.02	...	3,804
Inyanga	...	...	76	39	70.6	45.0	57.8	...	60.5	50.4	48	41	0.7	.14	.05	3	5,560
Bindura...	...	...	84	39	77.0	47.3	62.2	...	60.5	53.3	62	47	1.5	...	Nil	...	3,800
Angus Ranch... ...	...	...	88	40	78.8	52.3	65.5	65.6	61.6	56.0	71	52	...	...	.12	...	2,300
New Year's Gift...	...	...	87	41	78.4	52.2	65.3	...	62.4	56.1	67	51	...	.05	.23	1	2,700
Rusape...	...	...	80	33	72.9	42.9	57.9	...	58.9	52.4	65	47	0.7	...	.06	...	4,640
Riverdene North	...	...	87	30	78.0	39.7	58.8	...	50.7	48.2	83	46	...	...	.15	...	3,700
Stapleford...	...	...	72	30	63.8	39.8	51.8	...	56.6	51.3	49	47	1.8	.08	.64	2	5,450
Umtali...	896.9	895.7	84	38	75.6	50.3	63.0	62.6	64.0	56.5	63	51	1.3	.19	.21	1	3,677
Victoria	899.4	899.0	83	32	75.4	43.6	59.5	59.9	59.3	53.0	65	48	1.4	...	.07	...	3,580
Melsetter	853.5	...	79	38	72.2	48.2	60.2	...	62.6	53.0	52	45	0.9	.04	.60	1	5,060
Mount Selinda ...	...	...	82	40	70.1	52.1	61.1	...	60.0	55.9	77	53	1.9	.24	.60	2	3,520
Manchester...	...	...	75	35	65.2	46.8	56.0	...	52.4	48.9	78	45	...	.58	...	1	...
Mtoko	...	...	83	44	75.4	52.0	63.7	...	62.9	55.1	61	49	0.7	...	Nil	...	4,190

Farming Calendar.

JULY.

BEE-KEEPING.

The warmer bees are kept during this month so much the stronger will they come out in the spring. Provide a thickness of 3 inches of cloth coverings over the frames, and where quilts are, on examination, found to be damp, replace them with dry ones. This is a favourable season to carry our repairs to hives. All section and shallow frame combs must be carefully stored away from ants and mice, as these will be wanted for the excellent honey to be stored in them next October, collected from the bush bloom.

CITRUS FRUITS.

The harvesting of mid-season oranges should be completed early in the month; late varieties should be fit to export by the middle of the month. The dead wood should be broken and cut out of all harvested trees; this will minimise mechanical injury occurring with next season's fruit. Trees that are to be fumigated should have the lower lateral branches that touch the soil removed. Trim the trees until all foliage is just clear of the ground. The irrigation of late varieties must be continued and the cultivators kept going. Mark all trees when in fruit if the quality is bad; these may be cut back in August for top working to a good quality fruit. The soil of the early and mid-season varieties may be allowed to become fairly dry, for irrigation of the harvested trees may start an out-of-season growth which will enable pests to flourish and increase for the main spring blossoming flush.

CROPS.

Support agricultural shows, and add to your list of exhibits. Advertise your goods through the shows. Interested people will see them. If you require to make purchases of seed for next season, judge by the exhibits on the show what grower can best supply your needs, and place your orders accordingly. Attend the shows and go there to learn all you can about your business, not merely to have a good time. Seed maize previously selected in the field should be butted and tipped and hand shelled. Keep the butt and tip grain for check-row planting by hand. Do not over-irrigate winter crops, and do not irrigate when the wind is from the south, as this often means frost at this time of year. Troublesome weeds, such as darnel grass or drabok, may be removed from cereal crops by hand. Ploughing should be pressed on with, and maize stalks and roots of maize and other trash from the crop should be collected and burned very thoroughly. A land littered with unburnt and unrotted stalks and roots cannot be brought to a suitable tilth for planting and subsequent cultivation. Silage and sweet potatoes and other succulent feeds will have come into general use now, the potatoes being lifted from the land as required. The application of phosphatic fertilisers which are to be ploughed or harrowed in can be begun. Take the opportunity, during this and the next month or two, of inspecting all boundary and paddock fencing and gates, and effect repairs where required. Give a coat of paint to implements, wagons and carts. This protects the woodwork from rotting and the iron from rust.

DAIRYING.

This is one of the coldest months of the year, and milk production as a rule is low. Those cows which are being milked should receive a full winter ration of succulents (ensilage, pumpkins or majordas), hay and concentrates. Milking cows should either be under shelter at night or kraals should be sheltered against cold winds. The old adage, "Shelter is as good as a meal," should be remembered throughout the winter months.

No difficulty should be experienced in producing first-grade cream at this time. In cold, windy weather due precautions should be taken to ensure that the milk when separated is not below 90 degrees.

Most cheese-makers cease their cheese-making operations at the end of the month, as the milk generally not only is scarce, but begins to be deficient in butter fat. Cheese in the store-room should be carefully watched, as cheese mite is likely to appear on old mature cheese. In order to prevent the undue drying out of the cheese, the floor of the cheese room should be sprayed with water from a watering can.

Butter-making is sometimes difficult because of the low temperature of the cream. The temperature should be raised by immersing the can in warm (not hot) water until churning temperature is attained.

DECIDUOUS FRUITS.

Pruning must be continued, and if possible completed this month. The planting of all varieties is best if done now. Add a liberal amount of water at planting time, then cultivate the basins. Sufficient moisture will be thus retained to keep the newly planted trees going until they start active growth. Repeat waterings when necessary. If trees arrive from the nurseryman in a dry and withered condition, immerse them in water for twelve or more hours until they regain turgidity; then plant. Running water is best. Keep cultivators going. It will be advisable to irrigate all trees towards the end of the month.

ENTOMOLOGICAL.

Cabbage Family.—Plants of this family suffer from cabbage louse and Bagrada bug during July. Young louse-infested cabbage should be sprayed regularly with a forceful stream of water to dislodge the insects; or if this fails, spray with tobacco extract and soap. The Bagrada bug is difficult to control. Strong tobacco wash and soap, resin wash or an oil spray may be effective, especially against the younger stages. Daily hand picking is useful. Keep plants growing vigorously.

Fig.—The winter crop of fruit is liable to suffer from fig weevil. The infested fruit should be collected and destroyed. If this has been done regularly with the first crop, the second crop is not likely to suffer much.

Maize Beetle.—Infested lands to be thoroughly ploughed throughout the winter.

FLOWER GARDEN.

Seeds of most annuals, perennials, shrubs and ornamental trees may be sown. The pruning of roses should be attended to early. Dahlias and other summer-flowering bulbs should be taken up, divided and replanted. Sweet peas require attention and staking.

VEGETABLE GARDEN.

Sow turnips, peas, cabbage, beet, carrots, parsnips, radishes, lettuce and spinach.

FORESTRY.

Care should be taken to protect all plantations from fire by hoeing or ploughing belts round them and burning any grass likely to be dangerous. Cuttings of various deciduous trees may be taken and struck in nurseries. Continue pricking out conifers into tins or beds. In preparation for early planting in case the season is favourable, limited sowings of tree seeds may be carried out. If labour is available, preparation of land for planting to be taken in hand.

GENERAL.

Veld fires must be watched for and arrangements made to combat them. The loss that may result and the penalties under the Herbage Preservation Ordinance are to be borne in mind. Fire guards should this month be burnt round all grazing which it is desired to preserve for use later on.

POULTRY.

With the cold weather that we generally have in July, the birds should have extra food, i.e., barley or maize, if the supply of eggs is to be continued. A mixture of stewed linseed and bran should be given to the birds, warm, the last thing before they go to roost. This gives them a little extra food during the long and cold hours of the night at this time of the year and maintains the body heat. A certain amount of shelter is also necessary to protect them from the cold winds. Grass wind breaks about 3 feet high on the windward side of the run are sufficient. Remember that no chickens should be hatched after August; those hatched later take much longer to develop than those hatched before August, and they are usually stunted, weakly and unprofitable. Each month the young stock should be gone through and graded; anything that does not promise to be good should be got rid of. As the hatching season draws to a close, the breeding stock, if not carefully watched and treated, will become run down, and infertile eggs and weak chicks will be the result. Watch the breeding stock carefully and handle them occasionally; if they feel thin and light or the flesh is not hard but flabby, give extra food and more scratching exercise. The male especially should be well looked after and given a meal on three or four days of each week by himself; in addition, he should have some raw meat as often as possible. Good hatching and strong, healthy chicks are wanted right up to the end.

Turkeys should now be in full lay. Never disturb the hens when they are sitting. They are very sensitive and nervous, and unless left mainly to themselves, are apt to desert the eggs or break them. It is recommended that turkey chicks be reared by hand; the hens are poor mothers, they are clumsy, drag their chicks all over the place, and do not feed them as well as an ordinary hen does. The main thing is to keep the young turkeys warm, give them plenty of fresh air, thick separated milk and chopped onions or onion tops.

STOCK.

Cattle.—The bulls may again be put into the herd at the end of the month. Watch for any unthrifty cattle and get them into the home paddock and feed them before they become really poor. The value of a good provision for winter feed will be apparent now. Except under purely ranching conditions winter feeding should be general. Where areas have been properly reserved for winter grazing these should be in use now. The treatment of the dairy herd should be continued on the same lines as in June.

Sheep.—Vleis should now be fairly dry and may be utilised. There is, however, always the danger of internal parasites, and, where feed or grazing can be provided elsewhere, it is better to avoid vleis.

VETERINARY.

Horse-sickness and blue tongue should now have disappeared. Redwater and gallsickness occur all the year round, but the worst time is during the summer, when ticks are prevalent. Sheep may be inoculated against blue tongue now. Scab in sheep will probably be in evidence this month.

WEATHER.

Though rains have fallen during every month of the year in Rhodesia, none is looked for or desired this month. Most stations record an average of .01 to .3 inches over a number of years. Severe cold is likely to occur at this time of year, the lowest temperatures occurring an hour or two before sunrise. Frosts may be looked for, especially on calm clear nights. Cold windy days and damp "guti" weather tell severely on cattle, if shelter and food are not provided.

AUGUST.

BEE-KEEPING.

This month is one of inaction as far as the apiarist is concerned and the hive inmates are best left alone, except that once a week a corner of the quilt on the top crate may be lifted to see if the wax moth has gained a footing, as it may do in a colony weakened by death from sundry causes, and in which case all such frames should at once be removed. Towards the end of the month, with warmer weather the bees will be tempted out for play spells, cleansing flights, etc., and, according to the season, entrance stops may be opened out slightly with advantage.

In the workshop see that a spare hive or two are in readiness, well painted and ready for use at any hour; also have in readiness any requisite spares, and see that all appliances, such as veil, smoker, fuel, etc., are handy, for swarms may now go and come at a few minutes' notice. Where the bees have been left to their winter quarters with a fair supply of food, good results can confidently be looked forward to for the coming honey flow of the early winter weeks.

CITRUS FRUITS.

The first or spring growth should commence about the middle of the month, and the trees should have a good soaking of water when the new growth commences. If Washington Navel oranges are to set their main crop, frequent irrigations must take place from the time of blossoming up to the rainy season. These irrigations create the necessary humid conditions which are so essential to secure a satisfactory setting of this orange. It is advisable to stimulate the growth of unthrifty trees with an application of one to one and a half pounds of nitrate of soda when the first irrigation is given, this application of fertiliser to be followed by good cultivation. The amount of fertiliser recommended is for mature trees. The packing of late varieties will continue throughout the month. No bearing trees should suffer for want of moisture. Irrigation should not take place immediately before the harvesting of export fruit—at least ten days should elapse between irrigation and the harvesting. This is the best month to cut down citrus trees for re-working to better varieties. As the citrus trees are harvested, all dead, diseased and broken branches and shoots should be carefully cut out before the trees come into new growth.

CROPS.

If not already marketed, the main potato crop will probably be sold about now. Do not forget to grade the potatoes properly according to size. The buyer wants potatoes—table or seed—of even size, not large and small indiscriminately mixed. Select and clean farm-grown seeds ready for next season's planting. Label the bags with name and weight of contents.

Build a proper shed for your seed potatoes on the lines recommended in the *Rhodesia Agricultural Journal.* Sort over seed potatoes in store and remove any diseased or rotten. Green oat or barley fodder on wet vleis, or under irrigation, will become ready for cutting. Press on with ploughing and cross-ploughing. Decide what crops are to be grown next season, and, if you think fit, discuss the matter with officers of the Department of Agriculture. If you have not already effected all your purchases, consider the question of what seed you will require to buy for next season, and discuss the matter with other farmers. If in doubt, consult the Department of Agriculture. In frost-free situations, potatoes can be planted for an early crop under irrigation or on damp land. Cart and spread your farm-yard manure and plough it under as soon as spread to avoid loss. If you have any long stable manure, apply it to your heaviest land. The application of phosphatic fertilisers to the land can continue. If you do not already have one, put up an implement shed, even if it be only poles and grass. Keep wagons and Scotch carts under a similar shed or in the shade of trees. Speed up the making and burning of bricks if this is still in progress.

DAIRYING.

At this time of the year the farmer should experience very little difficulty in producing cream of first-grade quality. As a rule the weather is sufficiently cold to prevent cream, produced under average conditions, from undergoing rapid deterioration, and it is not usually necessary, therefore, to separate a cream of such high butter fat content as is required during the warmer months of the year. During the winter months the separator should be adjusted so as to deliver cream testing 40 to 45 per cent. butter fat.

On exceptionally cold days care should be taken that the milk is not allowed to become too cold before separation—for efficient skimming, the milk should be separated immediately after milking and at a temperature not lower than 90 degrees F.

Farmers engaged in butter-making are usually successful in obtaining a good grain and firm body in butter at this season of the year. Cream can quite easily be cooled to churning temperature if placed outside the dairy and exposed to the atmosphere overnight. During cold weather, however, it is more frequently necessary to warm the cream for churning. The most satisfactory method of warming the cream to the proper churning temperature is to place the bucket or receptacle containing the cream in a tub or bath of water at a temperature of about 95 degrees F., stir the cream frequently and replace the water when cold.

This is usually a critical time of the year for young dairy stock. For dairy heifers, weaned calves, etc., there is possibly no better ration than one consisting of maize silage, legume hay and mixed concentrates, and these feeds, if supplied in liberal quantities, should serve to keep the young stock in a thrifty, growing condition.

DECIDUOUS FRUITS.

All plantings of deciduous trees should be completed by now, as the late planting of these trees is generally unsatisfactory. Pruning may be continued up to the middle of the month. It is advisable to water or irrigate all deciduous trees before blossoming; if possible, a second irrigation should be given after the trees have set their fruit. Follow up the irrigations with good cultivation.

ENTOMOLOGICAL.

Potato.—Early planted crops of potatoes may be attacked by caterpillers. The crops should be sprayed immediately with arsenical wash such as lead arsenate powder, 1¼ lbs. to 40 gallons of water.

Cabbage Family.—Young plants of this family should be kept sprayed with an arsenical wash to check attack by web-worms. The formula given

for potatoes with the addition of ½ to 1 lb. of spreader to every hundred gallons of spray should be effective. If cabbage louse is also present add tobacco extract, 1 part to 80 parts spray. Do not spray plants of which the foliage is to be eaten within three weeks.

Citrus Trees.—May be sprayed or fumigated against scale insects, having regard, however, to presence of fruit and blossom. Spraying and fumigating for scale should not be carried out whilst trees are in blossom. Clear young growth of aphis previous to blossoming, using nicotine tobacco wash or Derris.

Guava.—Collect and destroy remnants of late crops to keep down citrus codling, especially if trees are in vicinity of citrus orchards.

FLOWER GARDEN.

Complete digging or forking over the soil as early as possible. Divide and replant dahlias, delphiniums, Shasta daisies, etc. Plant bulbs—tuberose, arum lilies and gladioli. Sow seeds of hardy annuals. Mulch newly-planted roses, shrubs, etc.

VEGETABLE GARDEN.

Plant out asparagus, cabbage,, cauliflowers, onions and early potatoes. Sow seeds of tomato and other plants that are susceptible to frost in a sheltered position; also seeds of various vegetables and salads for summer use.

FORESTRY.

Cuttings of ornamental shrubs, roses. etc., struck in sand last month should be transplanted into good soil as soon as they show a good healthy growth of leaves. A large percentage of cuttings will damp off if left in sand longer than about six weeks. No manure should be added to the potting soil. Seed beds should be prepared and gum seeds sown if required for planting early in the season. If the trees are to be grown in seed beds only and not in tins, then gum seeds should not be sown until October, or later, as they will get too large.

GENERAL.

Fire guards should be completed and every precaution taken to guard against loss of grazing from fires. Natives commence ploughing their softer land this month, and for this reason, as well as because beer is plentiful at the kraals, local labour is apt to be scarce. At this time of the year, however, the need for boys on farms is not so severely felt as later on.

POULTRY.

By the end of this month all those who are not able to give much attention to the chicks while in the growing stage should have stopped hatching. Those who can give some extra care, can continue hatching for another month, but not later, for chicks hatched after August are usually slow in growth and weedy. They do not lay till some months after they should, and eggs are few in number; in fact, they are generally unprofitable.

Now that the hot weather is approaching, a constant war on insects must be carried out, and of these sand fleas and fowl ticks (erroneously called tampans) will be found to be the most troublesome. A bulletin on fowl ticks can be obtained upon application to the Poultry Expert, Department of Agriculture. Sand fleas, as most poultry keepers know. are found on the face, wattles, ear-lobes and combs of the birds. Application of carbolised vaseline will usually kill them at once, or two or three applications of any ordinary grease on successive days are efficacious. More than this is, however, necessary, for the breeding quarters of these insects (and they multiply very rapidly) are in the dust on the floor of the house and that of the run.

The best preventive is a hard floor (preferably of concrete) with no cracks. If this is not possible, the floor and around the house should be treated every week in one of the following ways:—(1) Thorough soaking with a solution of one teacupful of Kerol, Jeyes, Hycol, Izal, or similar disinfectant to a paraffin tin of water, or (2) with a strong solution of salt and water, or (3) dusting over and raking into the soil a mixture of one part flowers of sulphur and two parts finely powdered lime.

Ducks.—See that the breeding ducks have plenty of water, and if possible also some to swim in. Keep young ducklings out of the hot sun, otherwise there will be many deaths. The same applies to geese and goslings.

Turkeys.—Young turkeys must be protected from cold at night, for this is fatal to them. Give them as much free range as possible. and do not allow them to run round the house or on the same ground as fowls do. Turkeys like clean ground; any that is tainted is very detrimental to them. Let them find most of their food in the bush.

STOCK.

Cattle.—On the early granite and sand veld probably the worst of winter is over so far as grazing is concerned, and a nice bite of green grass is appearing. Care should be taken where cattle are allowed to graze on the early burnt grass not to let them get too much at first. On red soil farms the haystack will still be required, and in all cases a certain amount of hay or ensilage should be held in reserve against the possibility of very late rains. In dairy herds on any soils whatever, feeding, housing and bedding should not be relaxed. A satisfactory ration for a medium producing cow in full milk is 5 lbs. of maize, 30 to 40 lbs. of ensilage or pumpkin and 8 to 10 lbs. of hay. If it is possible to give, in addition to the above daily ration, 2 lbs. of ground nuts, crushed with the shell, or oil cake, a very great benefit will be derived. Full particulars of the rationing of dairy cows can be obtained on application to the Department of Agriculture. Calves, especially young ones, must be carefully watched; they should not run too far, and are better inside, except when the weather is warm. They should be fed a little sweet hay, bean meal, linseed, ground nuts or ground nut cake and a small ration of green food.

Sheep.—Sheep should give little trouble at this time of the year. In many places now they will be grazing on the early "burns." The ewes and lambs should be given the best grazing available.

TOBACCO.

The seed bed site should be cleared and well ploughed, preparatory to burning and sowing. The usual date of sowing the first beds is the 15th September. Bulletins covering every phase of tobacco culture can be had upon application to the Editor.

VETERINARY.

Redwater and gall-sickness occur all the year round, although these diseases are more prevalent during the summer months. A good many deaths occur this month, however, amongst imported stock. Vegetable poisoning will probably be in evidence. Sheep can be inoculated against blue tongue. Scab is a poverty winter disease.

WEATHER.

No rain is to be expected, and even on our eastern mountains the precipitation is trifling. Showers, however, do occasionally fall in places, but are of no consequence. The sun is often warm during the day, but the nights are apt to be cold, and grazing being scarce, food and shelter are necessary for the stock.

Departmental Bulletins.

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Summary of the Game Laws of Southern Rhodesia.
No. 788. A List of Plant Diseases occuring in Southern Rhodesia, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A., Plant Pathologist.

THE RHODESIA

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Editorial.

Contributions and correspondence regarding subjects affecting the farming industry of Southern Rhodesia are invited. All communications regarding these matters and advertisements should be addressed to:—The Editor, Department of Agriculture, Salisbury.

Special Christmas Display of Rhodesian Chilled Beef.—An arrangement has just been made between the Director, Rhodes Matopos Estate, and the Rhodesian Export and Cold Storage Company, whereby a hundred specially selected steers from the Nuanetsi Ranch will be fed and finished for export at the Matopo Estate farm. The management and feeding of the cattle will be under the direction of Mr. C. A. Murray, Animal Husbandry Officer of the Matopo School, and it will be arranged that the steers are finished ready for shipment to the United Kingdom in time to form part of a special Christmas display of Rhodesian chilled meat.

Bounty on Export of Beef.—In order to enable the bounty on chilled beef exported from this Colony to be paid to the farmers without undue delay, the Government has now made a floating advance of £5,000 to the Rhodesian Export and Cold Storage Co., Ltd., to enable it to make payments direct to the farmers on behalf of the Government. We are sure that this arrangement will be appreciated by all the farmers concerned, and we trust that it will encourage farmers to maintain shipments notwithstanding the low prices which have been received for the shipments made up to the present. The necessity of maintaining shipments is recognised by all, and it is hoped that more satisfactory prices may be secured in the next month or two.

We understand that with a view of giving something tangible to work on, the above Company guarantees to pay not less than 20s. per 100 lbs. dressed weight at works, Bulawayo, for prime stall fed oxen; this price being inclusive of bounty, so that an ox weighing 650 lbs. will return £6 10s.

Typical Ear of Salisbury White Maize.—The Division of Plant Industry supplies the following notes on the characteristics of a typical cob of Salisbury White Maize.

After many years of continuous selection to somewhat differing types on the part of various growers of this variety, a point was reached in the history of "Salisbury White" where it became imperative to define officially the characteristics of the typical ear of this breed of maize. In the interests of both Exhibitors and Judges it was considered desirable to lay down standards for the variety which would ensure uniformity in selection for breeding and exhibition purposes.

In accordance with the request of certain exhibitors the Executive Committee of the Maize Breeders', Growers' and Judges' Association of Rhodesia passed a resolution to the above effect at a meeting held on the 2nd November, 1932, and appointed a sub-committee to meet and lay down as definitely as possible the characteristics and type for ears of Salisbury White Maize.

The sub-committee comprised the following members:—H. B. Christian; T. J. Mossop; A. Pearson; Geo. Rattray; J. M. Moubray; F. C. Peak; H. C. Arnold; D. E. McLoughlin, Chairman; (official judges of the Association) C. Mainwaring; J. A. T. Walters; W. A. Ludgater and H. G. Mundy, Acting Secretary for Agriculture.

This latter met on the 11th April, 1933, and approved of the following standard for the breed:—

1. Ears bold and heavy; as nearly cylindrical as possible.
2. Length of ear, 9 to 10 inches.
3. Circumference of ear (3 inches from butt) 7.25 to 8 inches.
4. Number of rows, 12.
5. Sulci, as narrow and straight as possible.
6. Tips well covered with grain, uniform in type to those on remainder of the ear.
7. Butts, bold and well filled, extending beyond the core and neatly rounded.
8. Core, medium in size.
9. Kernels firm and upright on cob; deep and of very uniform thickness throughout the rows.
10. Colour of grain; ivory white with opaque white cap.
11. Crease-dented, with tendency to rough pinch but without any distinctly beaked projection from summit of kernel.

Prime Minister Visits Eastern Border.—The Hon. George Mitchell, Prime Minister and Minister of Mines and Agriculture, opened the Agricultural Show at Umtali on the 21st July, and subsequently paid a short visit to the Melsetter district. This was his first visit to the latter area, and while there he took the opportunity of discussing with the Village Management Board and other local authorities the question of laying out residential and agricultural plots on the commonage.

Tobacco Seedbeds—A Reminder.—The seedbeds are the foundation of the tobacco crop, and it is therefore extremely important that due care be exercised in the selection of a site where the soil is suitable for the production of strong and healthy seedlings. Any land likely to be infested with nematode or root-gall worm should be avoided; this pest caused considerable damage last season. An adequate and uncontaminated water supply is another important factor. The proper sterilization of the seedbeds often does not receive the consideration which it deserves and consequently trouble is experienced through weeds and insect pests. In order to effect economy a number of growers are now using grass coverings in place of cheesecloth, and where the former is employed it should be remembered that the grass should be lifted as soon as the seeds germinate and be gradually thinned out thereafter to provide the necessary light and aeration. The rate of sowing the seed should also be such that the beds are not too thickly seeded, crowded seedlings do not make satisfactory growth and are more subject to disease. The choice of seed is very important and only reliable seed of the types of tobacco suitable for market requirements and suited to local soil and climatic conditions should be used. All seed should be treated before sowing and regular spraying of seedbeds is recommended for the control of disease and against insect pests.

Visit of Minister to Pretoria.—During July the Minister of Mines and Agriculture, accompanied by the Acting Secretary, visited Pretoria to discuss with General Hertzog and General Kemp matters concerning the interchange of animal and vegetable products between this Colony and the Union of South Africa. We are glad to state that the result of this visit is likely very shortly to lead to the removal of many of the irksome restrictions in respect of Foot and Mouth disease, which at present hamper trade relations between the two territories.

The representations made on behalf of Southern Rhodesia were received in a very sympathetic and helpful manner by the Union Ministers concerned, and the discussions have undoubtedly resulted in a better mutual understanding of the

difficulties with which each State is confronted in respect to inter-trade in various animal and vegetable products.

Amongst other important matters discussed were Southern Rhodesia's export of chilled meat from the Cold Storage Works in Bulawayo; the possibility of opening the Beitbridge-Durban railway route for cattle on the hoof for slaughter in Durban; provision for shipping space for Rhodesian chilled meat in Union-Castle vessels; the exemption of Southern Rhodesian exporters from the operations of the Union egg levy, and an alteration in the date of commencement of the tobacco quota. Further consultation on both sides is necessary before final agreements in respect of these matters can be reached, but it is hoped that a more definite pronouncement will be possible in the near future.

Grading Beef for Export.—During last month Dr. D. J. Schutte, Senior Animal Husbandry Officer of the Union Department of Agriculture, visited this Colony in connection with the inspection of chilled beef. Arrangements were made for him to visit a number of the larger ranches in Matabeleland and to inspect a shipment being prepared at the Cold Storage Works in Bulawayo. Later he visited Salisbury, where he inspected cattle on the farms of Messrs. Newmarch and Maclean, Duncan Black and C. C. Macarthur.

Dr. Schutte stated that he was very much impressed with the cattle potentialities of Southern Rhodesia.

The Black Maize Beetle.

(*HETERONYCHUS LICAS*, KLUG.)

OBSERVATIONS ON LIFE HISTORY AND CONTROL.

By C. B. SYMES, Entomologist.

NOTE.—Some eight years ago, in the February and April numbers of this Journal, 1925, Mr. C. B. Symes, who was then on the Entomologist's staff of this Department, published a comprehensive article on the Black Maize Beetle. This is now out of print and the following extracts from the original article are published to meet the growing demand for information on this important maize pest.

History of Outbreaks and Economic Importance.—The first definite outbreak of the pest occurred in 1912 at Macheke and immediately adjoining a low-lying wet area of black open vlei soil, and in the same year on dark "naturally moist" sand at Iron Mine Hill. In the following year destruction occurred again in these districts and at Lalapansi and Norton. During 1914, 1915 and 1916 outbreaks occurred, but the damage was less serious. The season 1917-18 is notable for a wide and serious outbreak in the Gwelo district; several farms were badly infested here and at Lalapansi. In Mashonaland, destruction occurred at Hartley and in the Salisbury district. From that time onwards until 1921 damage became more serious annually; very many farms were involved, and the position in Gwelo, Hunter's Road, Somabula, Shangani and Lalapansi districts became very grave. No further outbreaks were recorded in Mashonaland until December, 1922, when a severe infestation occurred on two newly-broken vlei lands in Lomagundi.

The importance of the pest cannot be fully appreciated except by a tour through infested districts when destruction is at its worst. Insect pests of field crops normally are respon-

sible for serious reductions of yield, sometimes amounting to 5 per cent. or 10 per cent. of crops; the maize beetle, however, during 1921 was responsible for destruction varying from 25 per cent. to 100 per cent. of many crops in the Midlands. The majority of lands infested were planted twice and some three times, each successive crop being "eaten out" by the pest. In one notable instance the crop on lands well over a hundred acres in extent was eaten out immediately after the plants showed themselves above ground. A second planting was carried out with the same result; not half an acre of maize remained. More fortunate growers reaped a quarter to three-quarters of their crops. Wherever maize was planted on or near vlei lands, great damage resulted, aggregating many thousands of pounds and threatening the existence of this very essential industry. In fact, after continual losses some farmers allowed large and valuable areas of land to go out of production, and others were obliged to grow less profitable crops on their best maize lands. Thanks to the droughts of 1922 and 1924, however, this very grave position of many growers has greatly improved. It is hoped that the following notes will tend to make such improvement a permanent one and thus dispense with the need for the good services of another drought.

Species Involved in Outbreaks.—The destruction at first attributed to one species was found to be the work of many collections of adults, which at various times have included the following species:—*H. licas, dissidens, foveolatus, arator, inops* and *pauperatus.*

H. licas is, however, most frequently met with, and is associated with the very serious destruction to crops in the Gwelo district. *H. inops* appears to be a sand veld species and is responsible for the damage in the Somabula and Shangani districts, where *H. pauperatus* is also found. *H. dissidens* and *foveolatus* were concerned in a severe outbreak in Lomagundi.

All species adopt the same method of attack on young maize plants, and all are alike in their need of moist conditions.

EGGS.

The newly-deposited eggs (Plate I.) is opaque white in colour, and measures from 2 mm. to 2.1 mm. in length, and 1.4 mm. to 1.7 mm. in breadth. As with all other eggs of this family of beetles, a considerable increase in size occurs during the period of incubation, and the pronounced ovoid shape is lost. Just before hatching, the measurements are 2.9 mm. to 3 mm. long and 2.5 mm. to 5.6 mm. wide. At this time the egg appears glassy white, and the faint lines of the developing larva can be seen.

Where Eggs are Laid.—Eggs are deposited in the soil at depths varying with the moisture content. In the breeding experiments eggs have been found at one inch below the surface in very wet soil, whilst in the drier soils they were deposited at depths of four and six inches.

Saturated soil is avoided by the ovipositing females. The conditions which are apparently sought by females are moisture and solidity of soil. The amount of moisture necessary to induce oviposition has not been determined, but ova are always found in soil that is well moist or even wet. The degree of moisture determines, to a great extent, the degree of solidity of the soil. Where there is no vegetation, surface soil to a depth of one or two inches is liable to dry out thoroughly, and is therefore quite unsuitable for egg-laying. Moreover, in clean cultivated lands the surface soil is quite friable during the rains, and to the risk of desiccation is added that of destruction by soil pressure. Below this friable layer the soil is solid and moist to a greater degree, the latter depending upon the height of the water table. It is just below the top friable layer, at a depth of 2½ inches to 3 inches, that the majority of ova were deposited in the breeding experiments. Where grass occurs in breeding grounds more soil moisture is retained than in bare soil, and here eggs are often found actually at the roots of the grass about one inch below the surface level. Similarly in damp areas eggs have been found at the base of swamp grasses (*Cyperus* sp.) and even at maize roots. In the field eggs are thus deposited beneath grasses. Eggs are laid in lumps of soil.

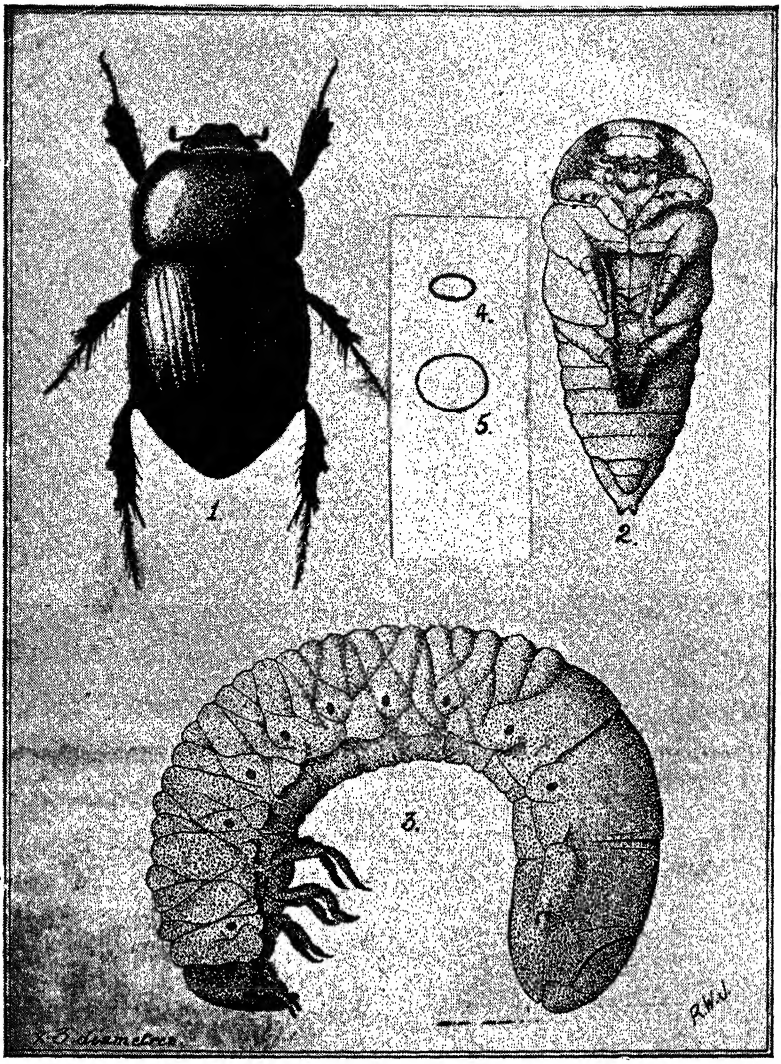

PLATE I.

FIG. 1.—*H. licas*, Klug. Adult female.
FIG. 2.—Pupa.
FIG. 3.—Larva.
FIG. 4.—A newly deposited egg (x 3).
FIG. 5.—Egg just before hatching (x 3).

(Figs. 1, 2 and 3 after Jack).

At the laboratory, kraal manure was intermixed with soil in many experiments, and the eggs were found frequently in the small lumps of the manure. Where no manure was added they were discovered in small portions of *red* soil about the size of a pea. Frequently two eggs were found in the same piece of soil, and where this occurred they were apparently of different ages, one being much bigger and rounder than the other; such eggs hatched at different times. It appears, therefore, that in the confines of a breeding plot females oviposited on two different occasions in the same lump of soil.

The act of oviposition has not been witnessed, but from the fact that eggs are entirely enclosed in their soil coverings it would seem that the process is somewhat similar to that employed by the "dung rollers" and other dynastids.

The egg itself is ensconced in a tiny cell structure, to which it is attached on one side.

Incubation Period.—The conditions sought by the females for egg-laying are the optimum conditions for the development of eggs, and in such "normal" circumstances eggs hatch in from seventeen to twenty-five days.

Effect of Drought on Ova.—It was considered that ova deposited later in the summer or autumn might possibly remain dormant through the dry season and hatch after the springs rains. This apparently does not happen. Experiments were conducted in which many eggs at various stages of development were carefully placed in mixed soil and manure on 5th February, 1923. The tin containers were placed on the bench in the out-door insectary and no water was given. Three of the well developed eggs hatched; the remainder first became wrinkled and then collapsed.

The larvæ resulting from the hatched eggs carried on a precarious existence in their dry surroundings. On 4th May, 1923—three months later—one had reached the third stage and two were still in their second stage of development. All were dwarfed and very much shrivelled, and died during that month.

On one occasion six newly-deposited ova were accidentally left exposed to the air for one and a half hours. They were

then put into mixed soil and manure in small pots and given a continuous water supply. Hatching occurred quite normally in twenty to twenty-one days.

Effect of Excess of Water on Ova.—It has been stated that ova are deposited at a depth in the soil dependent upon the degree of moisture present. Breeding pots have been allowed to dry out to a depth of five or six inches and eggs have been found progressively lower as the soil dried out. Several of such pots, in which, however, the soil had not been disturbed, in order not to break up the lumps containing eggs, were transferred to troughs in which water stood at a depth sufficient to bring about a sudden rise in the water table in the pots.

Eggs situated in the lower layers of soil were, therefore, surrounded by a state of saturation. Examination of these pots at various periods resulted in the discovery of eggs in apparent good condition and well developed and of larvæ newly emerged—all in saturated soil.

Other experiments involved the removal of eggs from the soil in which they were deposited in small pots, the soil of which was kept in a state approaching saturation. These eggs all failed to hatch. Many broke down as the result of what appeared to be fungus parasite, and others were attacked by worms. It is probable, however, that both parasites were saprophytic and attacked the eggs after their vitality had been destroyed by the unfavourable conditions. From these experiments it seems that the tiny earthen cells in which eggs are deposited afford considerable protection against the effect of excessive moisture.

Mr. R. L. Thompson, who carried out investigations during the earlier outbreaks of this pest in Southern Rhodesia, records the following experiment:—"12th April, 1915, four ova placed in petri dish and submerged in water till 19th April, 1915. All hatched."

It seems, therefore, that eggs can survive very considerable periods of absolute saturation.

In the field the permanent breeding grounds are often on the edges of swampy vlei soils; during the rainy season these are sometimes saturated for a month or more. It is

evident, therefore, that eggs are immune to the effects of excessive moisture to a very considerable degree under natural conditions.

LARVÆ.

Description of Larvæ.—The larvæ of *Heteronychus licas* are typical "white grubs" in shape and appearance, except that during their feeding period they assume a bluish grey colour, due to the humus in the alimentary canal. On this background of colour the nine white spiracles stand out very clearly on each side of the body; one just behind the head on the first thoracic segment, and eight on the segments of the abdomen.

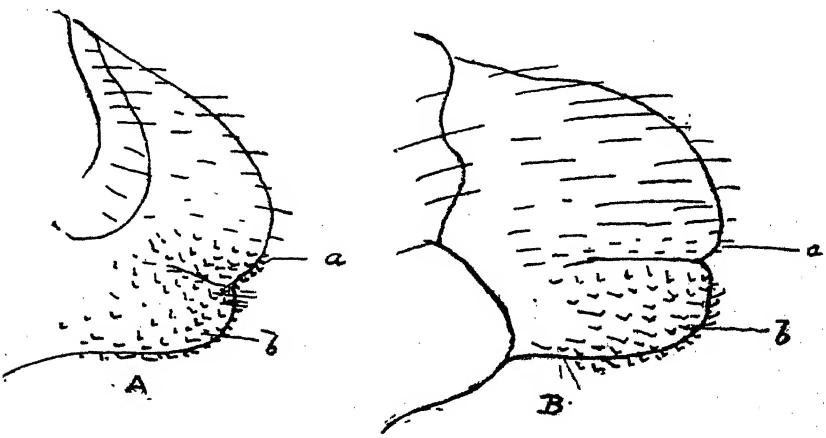

FIG. 1.—Sketch showing curved spines on anal segment of *Heteronychus* (A) and *Melolonthid* or *Rutelid* (B) larvæ (after Jack).
(a) Dorsal of anal opening. (b) Ventral.

Larvæ Development.—The newly hatched larvæ are entirely white, and measure 5 mm. to 6 mm. In a few hours after emerging from the eggs the head capsules and other chitinous parts become red brown in colour. At this stage the head measures 1.5 mm. in width. In favourable surroundings—such as in the presence of kraal manure—growth is very rapid. The total feeding period of larvæ varies from fifty-seven to seventy days.

In the field the majority of feeding larvæ have been found between the end of December and the end of April. A few

were discovered in May and June of 1921—when the pest had reached the height of its development. Larvæ found in March and April, and later, have been well developed and approaching the full-fed condition.

It must be pointed out that throughout the whole of their developmental period, except during movement through the soil, larvæ exist curled up in cell-like structures. These structures may be simply the accidental shaping of damp soil by the movements of the larvæ during feeding, but they certainly appear to be the result of design. The cells seem to act much in the same way as the egg cells in affording a degree of immunity from the possible evil effects of very wet or very dry soil, by preventing the direct contact between larvæ and their surroundings. Larvæ taken from their cells, even in very swampy soil, are usually quite free from soil except on the dorsum of the last two segments. It is apparently by the movement of the hind end of the body that the cell-like cavities are shaped.

Prepupal Period.—Having become full grown, larvæ exhibit a degree of restlessness not observed at any other stage. In the insectary many climbed out of the breeding pots, some were lost, whilst others were discovered dead or dying on the floor of the cage. This happened evidently in pots that had been allowed to dry out. At this stage it is evident larvæ require moist soil—not that they may feed, but that they may construct the cells in which they spend the winter. Cells cannot be made in dry friable soil, hence the migration to seek more suitable surroundings. How far such movement takes place in the field cannot be stated, but it evidently does occur, and probably to a considerable extent. Where thorough drying of the soil does not occur, the full-grown larvæ merely burrow to greater depth, according to the degree of moisture present in the lower dryness of the soil. Here they construct their winter quarters. It has been stated that larvæ exist in cell-like structures throughout their period of development. The cells made for the long winter period are very much better made than the earlier ones; the walls are of well-compressed soil particles that set quite hard; the inside surfaces are smooth and sometimes appear to be slightly glazed; here is ample space, the volume of a cell being at least quite as large as that of its

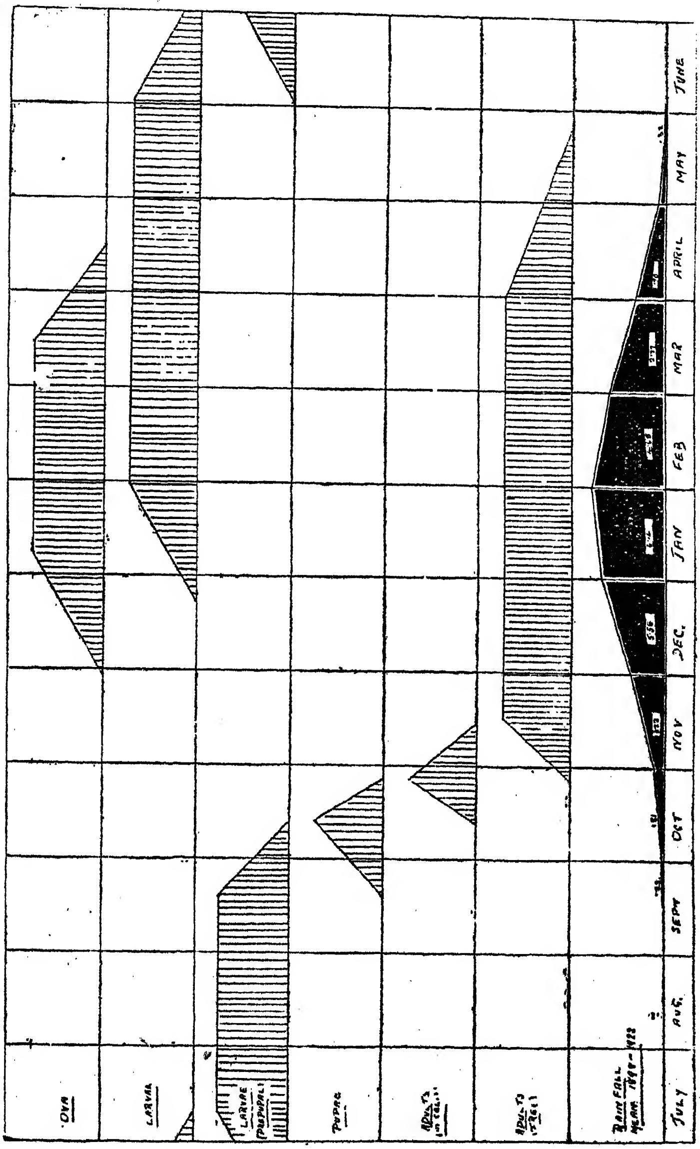

Diagram illustrating the occurrence of the various stages of *H. licus* during the year.

occupant. The great majority of larvæ in winter quarters are found with heads upwards. Larvæ ready to commence their winter resting period are robust specimens, white in colour, except for the last abdominal segment. The white colour is due to the accumulation of fat bodies.

The exact length of the wintering or prepupal period of larvæ is difficult to ascertain, since nearly all direct observation is fatal to the specimens. Immediately before assuming the pupal form the last moult occurs. It appears that in the insectary very few specimens, if any, cast their last skins before the first week in October; the majority would seem to have done this at the end of October. In the field, however, developed pupæ were found in some instances at the end of September. Local conditions are bound to influence the whole development of this insect. It may be sufficient to state, therefore, that normally the prepupal period lasts for from four to six months, depending greatly on the development during the feeding period; if this is rapid, the wintering period will be long, and *vice versa*.

Food of Larvæ.—It was found that breeding could be carried out most successfully in the insectary in a damp mixture of red (dolerite) soil and kraal manure; in this larvæ made rapid development. Equally favourable, as far as growth of larvæ is concerned, were red soil and refuse consisting of maize stalks, dried grass and so on. Many experiments were carried out to induce larval development in red soil without the addition of humus in any form. In every case the specimens developed very slowly indeed, and few only matured.

Other experiments comprised the planting of maize in breeding pots to ascertain the attitude of larvæ towards growing graminaceous plants. Details of such experiments are not necessary; they all go to prove that larvæ will feed on maize grains and on young maize plants whenever they are available, even in the presence of abundant humus in the soil. In other experiments larvæ were reared in the presence of growing velvet beans; no plants were eaten, in spite of the fact that no humus of any kind was added to the soil used.

In the field larvæ are found in positions surrounded by dead and living vegetable matter. In vleis the high percentage of humus and the abundance of grass roots provide ideal food supplies. On the higher soils—the light red and chocolate soils—food consists chiefly of either the roots or basis of living grass or the accumulation of dead vegetable matter at the base of the "tufts" or both. The grasses which appear to offer particularly favourable conditions are the larger, heavier types giving good cover and possessing a dense root system; *Brachiaria* and *Cyperus* sp. are examples of such grasses.

During field work it was observed repeatedly that newly ploughed grass land, where the grass is simply overturned, with the unbroken sod on top, was particularly attractive. Here there were good shelter and moisture, provided by the larger sod, and abundant food in the form of half buried rotting grass. Wherever such roughly ploughed spots were investigated, numbers of robust, healthy larvæ were discovered.

During investigation in the summer and autumn of 1921 the maize growing on dark soils of some farms was falling down; large numbers of full-grown plants bearing excellent cobs lay prostrate. Farmers suggested various reasons—wind, "white ants," and so on—for the occurrence, but investigation proved the damage to be due to the feeding of *Heteronychus* larvæ. At the base of all plants that had recently fallen two to four and sometimes more well-developed larvæ were found. An examination of the roots showed that they had been definitely eaten off just below the surface of the soil, and on several occasions, after great care in scraping away the soil, larvæ were seen in the act of feeding upon the roots of standing plants. This occurred only on chocolate and black soils.

Since that time several instances of destruction to maize roots by other scarabeid larvæ have been observed.

It is possible that under such conditions as these larvæ move laterally in the soil, from one plant to the next. It is not essential, however, since the roots of one maize plant would provide sufficient food for the complete development of three or four larvæ.

Position of Larvæ in Soil, and Movement.—In the field larvæ are found in just those positions which would seem to be ideal spots for egg-laying—at the roots of grasses, maize and reeds, and seldom more than three inches below the surface. During field work in 1921, where even high red lands were sufficiently moist to allow of breeding, many well-developed larvæ were found in the thick mats of vegetable debris at the base of "tufts" of grass, not actually below the surface of the soil. If the grass at the roots of which the majority of larvæ are found in the field is fairly dense, specimens find sufficient moisture for their requirements at positions about one to two inches below the surface; beneath small grass "tufts" larvæ occur usually at a greater depth. In the wet black soil of vleis the grubs are very seldom found lower than two inches.

That larvæ move up and down in the soil in accordance with the rise or fall in the moisture content is obvious from observations carried out in the insectary. Lateral movements, however, have not been observed, though it is possible that such movement does take place to a slight extent in the field in response to both moisture and food requirements.

Conditions Suitable for Larval Development.—It may be stated that generally the conditions essential to the normal development of larvæ occur only in the low damp areas; the majority of these are vleis. Food in the form of soil humus and living grass roots or stems, permanent moisture and suitable physical conditions of soil are present here, even in a dry season. Larvæ in such surroundings have every chance of rapid development unless late excessive rains flood the areas, in which case it is probable that many perish.

Conditions on the higher and drier soils would appear to be favourable only in years of normal or excessive rainfall, and then only for larvæ that have hatched from early deposited eggs.

Resistance of Larvæ to Drought and Heat.—In ploughed lands living specimens were present in large, unbroken lumps of soil, which were often so dry and hard that a very consider-

able blow from a pick was necessary to break them. On the contrary, many *dead* specimens were found with cells intact in small lumps of soil about the size of a cricket ball. These appeared not to have succumbed to the attacks of any disease organism, but rather to the effect of heat and desiccation.

The temperature of the soil surface is very high during June, July and August, and this heat penetrates the smaller lumps of soil readily, though not the larger. It appears, therefore, that larvæ that are unfortunate enough to be wintering in positions lacking sufficient overhead shelter or depth of soil cannot survive the winter's sunshine.

Effect on Larvæ of Direct Sunshine.—Normally all stages of this insect are passed in the cool, damp shelter of the soil. It is only on dull and cool days that adults are seen actually walking on the surface, and then only very rarely are they away from shelter. The reason for this was sufficiently clear after a few experiments had been carried out. Healthy, feeding larvæ were taken from their breeding grounds and placed on a small area of hard, dry soil exposed to the sun, and away from any shelter whatever. Frantic efforts were made to escape to shelter, and after exposures varying from a half to one and a half minutes, all specimens were dead.

It may be noted here that young larvæ are quite lively when placed on the surface of soil; their activity decreases with age, however, the full-grown specimens experiencing considerable difficulty in transporting their very unwieldly abdomens. In soft soil, however, they readily burrow beneath the surface again. Over-wintering specimens, taken from their cells soon after they have started their resting period, are at first sluggish and then considerably more active than the full-fed specimens. In their more advanced state, in late August and September, however, they lose this activity, and having been once turned out of the soil, they are unable to help themselves, and perish. The sun has a similar, though quicker, fatal effect on larvæ at this stage.

Effect of Breaking Cells in which Larvæ are Wintering.—The frequent observation made in the insectary necessitated the breaking open of cell structures in which larvæ were

spending the winter. It was found that when this was done, in May and June, soon after the specimens had constructed their cells, larvæ were always able to reconstruct their quarters so long as moist soil was available. As the time between the commencement of this prepupal period and the destruction of the cells was prolonged, so the ability of disturbed specimens to reconstruct decreased. In late August and September, therefore, a high percentage of specimens taken from cells perished. The death rate increased in proportion to the dryness of the soil surroundings. It would seem that during the latest period the very complete physiological changes necessary for the transformation of a grub into a beetle reach a somewhat advanced stage, preventing an expenditure of energy such as is necessary in the construction of soil cells. Moreover, the delicate state of a larva in which these vital organic changes are taking place makes it very susceptible to violent changes of atmospheric conditions such as would occur through its removal from the enclosed space of a cell to the comparative exposure of the soil in general.

Effect of Excessive Moisture on Larvæ.—Healthy larvæ are often found in soils that are quite swampy. In the insectary it was possible to reproduce these conditions artificially and to observe the reaction of larvæ. At first laræ were introduced into breeding pots, the soil of which was permanently almost saturated layers of soil. Later, larvæ were introduced to pots in which the soil was allowed to dry out so that the specimens would burrow deeply to avoid the dry conditions. By examination the position of the majority of the larvæ was ascertained, and then by the addition of water to the trough the specimens were swamped.

The majority of larvæ subjected to this treatment perished; they had constructed fairly solid cells at the bottom of the pots and were apparently unable to escape the rising water. These specimens were big and nearly full grown. On the contrary, it was observed that younger larvæ, though similarly treated, were able frequently to avoid drowning,

probably by their greater activity in getting above the water level. Both young and older larvæ have been found in the field in saturated soils. On one occasion some four or five breeding pots had been given no water through the winter in order to avoid disturbing the wintering occupants. At the end of September water was put into the trough to a level about one and a half inches above the base of the pot. Examination a fortnight later showed that every wintering larva had succumbed. A few were actually below the water level, but the majority were well above, and their cells had not collapsed.

Many of the breeding pots were purposely kept moist until September and October, and it was noticed that the breaking open of cells of wintering larvæ at this time led to the death of the occupant. It would seem that the walls of the cells are sufficiently compact to shelter larvæ from the damp conditions of surrounding soil so long as these are not excessive. Exposure to even a moderate degree of moisture appears to be fatal.

PUPA.

The difficulty in connection with observations on the prepupal period occurs also in dealing with pupæ; many specimens uncovered died from the effects of exposure. In the insectary the majority of pupæ were found from the end of September to the end of October (1921), whilst in the boxes specimens were found as early as the beginning of August (1922) and the end of August (1923). The discoveries in the field have been few, though very long searches have been made. In 1921 the majority were found at the end of September. It can be definitely accepted, therefore, that pupation commences, under ordinary conditions, at the end of September or the beginning of October. The exact length of the pupal period was not ascertained. Specimens under observation in the laboratory required periods of twenty-three days, more than nineteen, twenty, twenty-two and twenty-five days and less than thirty-two days respectively.

It would seem that generally from three to four weeks is required for pupation.

The emergence of adults is no guide to the pupal period, since, having cast their pupal skins, specimens frequently remain in their cells for two or more weeks.

The last larval skin is invariably found in the pupal cell. If cells are examined before newly developed adults have emerged, the last larval and the pupal skins are found present at the lower end.

Position of Pupæ.—It is obvious that, since wintering larvæ pupate in their winter quarters, the positions in the soil of pupæ will coincide exactly with those of the wintering larvæ. Conditions necessary for pupation are a natural sequence to the requirements of the wintering larvæ. These points have already been discussed.

Effect of Breaking Pupal Cells. —Reference has been made to the difficulties of observation on specimens undergoing metamorphosis. Exposure to the free atmosphere appears to be fatal in every instance unless the processes of transformation are nearly complete. Numerous specimens have been opened up in their cells and then re-covered with soil, always with fatal results. In order to preserve pupæ alive it was found necessary to take them from the soil and keep them in an enclosed atmosphere; small glass tubes and dishes were used for this purpose. In the field every opportunity was taken to note the effects on pupæ of October ploughing. Long searches were made over lands so treated, and on many occasions pupæ were found exposed to the sun, dead. Other dead specimens have been found with broken cells, but still sheltered by lumps of soil. In one land of black soil pupæ were found dead in large lumps of soil overturned by the plough. It is probable that death is due to the severe drying effects of the atmosphere.

The texture of the soil itself determines the degree of drying out; some soils allow of greater penetration by air and heat than others.

Effect of Excess Moisture on Pupæ.—One experiment, similar to that described in connection with wintering larvæ, was carried out. Some six breedings pots, with many pupæ at various depths, were given water in October. On examina-

tion, all pupæ were found to be dead. As in the case of the larvæ, the cells were intact. Many specimens were well above the water level, but the surrounding soil was very wet. In the field, pupæ have been found in slightly moist soil, but never in wet soil. It is obvious that soil that remains really wet through the winter until the beginning of October would almost necessarily be entirely inundated during a great part of the egg-laying period; such a condition would be avoided by ovipositing females.

ADULTS.

Description.—The adults (Plate I., fig. 1) are true black beetles measuring from seven-sixteenths to three-quarters of an inch in length. Their shiny black appearance, dentate (toothed) front legs and the circumstances under which they are found should leave no doubt as to their identity.

Adults—Emergence.—After casting their pupal skins and becoming fully developed adults, the beetles are very light brown in colour and their wing cases are very soft. A few hours afterwards the brown colour has changed to shiny black, and the wing cases, head, thorax, legs and other chitinous parts have become very hard. In this state specimens wait in their cells for periods varying from a week to a month.

The actual conditions conducive to emergence are not known. From field observations, however, it is certain that beetles do not emerge until after the first rains; Mr. Jack, in his "Maize Beetle" (Bulletin No. 280), states, "The beetles become active with the first soaking rains of the season." Exactly how much rain is needed to induce emergence has not been ascertained. Emergence has taken place on lands which have received a precipitation of less than 2 inches. On the contrary, beetles have been found fully developed in cells in black vlei soil after 4 inches of rain has fallen. Usually, beetle activity is noticed only when an attack is being made on young maize; emergence in the field other than in association with the destruction of a crop has not been recorded. In the insectary breeding pots and boxes known to contain fully developed adults in cells have been given varying amounts of water to induce emergence; later examination has shown the

adults still in their cells. It can be stated definitely that the emergence of beetles in the field coincides with the first two or three inches of rain, and that generally all the beetles in one locality emerge simultaneously; beyond that we know nothing.

Food and Habits.—That maize is an irresistible attraction and that adults feed ravenously on it is well known to very many farmers. In the insectary this food was supplied to all ordinary breeding pots. Many experiments have been carried out in an attempt to ascertain whether or not green food is essential; the data are insufficient to warrant any definite conclusion on this point, though they certainly suggest that beetles thrive and reproduce in the absence of green food so long as vegetable matter (humus) is present.

The attack on plants is carried out first below the surface of the soil. Damage is most characteristic. A large excavation is made usually from one side only in the young plants, and the tissues are eaten to a depth which includes the vital growing tips in the middle. Only very seldom is a plant actually severed; in this respect the damage usually differs from the work of cutworms. Having eaten well into the middle of the stems, the beetles usually make no attempt to feed higher or lower in the plants; they leave to feed on the next. In the field as many as six beetles have been found at the base of an injured plant. On a few occasions only, specimens have been seen to feed on maize grains; this is unusual. Grasses and young maize plants are attacked in the manner described, and Mr. Jack records laboratory feeding "more or less freely" on maize, kaffir corn, wheat, oats and barley.

In the field no damage has been observed on any crop other than maize and kaffir corn, though the observations on other cereals have been somewhat few. In many valley vleis a coarse spreading grass occurs; this is freely attacked in the characteristic manner.

Particular attention has been paid to the possibility of attack on other field crops such as sunflower, potatoes, velvet beans, lucerne, cow peas; but no evidence even suggestive of damage has been obtained. It is recorded in Bulletin No. 28

(Department of Agriculture, Salisbury, Rhodesia) that on one occasion a hungry beetle in captivity fed on a potato. Hungry specimens will also attempt to feed on one another and upon larvæ, both of their own species and of others.

It must be remembered that the sole aim in life of the adult beetles, as it is of any insect, is to reproduce; feeding is only a means to this end. All habits, therefore, are associated with either feeding or reproducing. Movement is indulged in instinctively, and this usually takes the form of walking. Flight may take place soon after emergence, but it is considered that once the active period of reproduction is started, beetles do not adopt this method of travel. All movement above the surface of the soil goes on only at night or during dull weather. Specimens do not expose themselves to sunlight; the few that have been found above the soil during field work have always been well sheltered beneath grass. An experiment was carried out to test the effect of the sun on exposed beetles. Many specimens were placed on a hard bare area of soil, away from all shelter and fully exposed to the sun. All made repeated attempts to get to the grass on the edge of the area, but this was prevented by the writer. In less than two minutes every beetle had rolled over on to its back and died.

That considerable powers of flight are possessed by the beetles is evident from the fact that specimens have been caught in light traps at night. The attraction to light appears to be quite strong; it is probable, however, that such attraction operates only within relatively small areas immediately surrounding the light. Specimens have been taken around the street lights in Salisbury.

Effect of Drought on Adult Activity.—It has already been shown that damp conditions are essential to the normal life of adults. Like the larvæ, they appear to be unable to a great extent to assimilate thoroughly dry foods and cannot endure the dessiccating effects of a hot sun or a dry atmosphere. This has been repeatedly noticed in the field.

Longevity of Adults.—In the field, specimens have been found in cells during the last week in October (1923). During the first and second week in November, 1921 and 1922, large

numbers were seen feeding on maize crops. Very few have been taken in late summer and autumn, a few in March and April being recorded in 1921 and 1923. None were taken at this period during 1922, the drought year.

The dates of the field catches agree quite well with results in the insectary, and it can be stated quite generally that adult life under normal conditions lasts from November until April and May.

Sexes.—Males and females occur in about equal numbers as far as can be ascertained. On one occasion a large number of specimens collected on a badly infested maize land consisted of 417 males and 455 females. In the breeding experiments of 1921-22 the proportion of males to females was 16-30. Copulation takes place soon after emergence, and is frequently carried out during the feeding and egg-laying period.

Natural Checks on Increase.—In addition to the severe checks on the development of this pest due to climatic factors already discussed, animal predators take their toll in all stages of the life cycle. On several occasions the breeding pots in the insectary were invaded by a species of small centipede which devoured the eggs in large numbers. Under very wet conditions eggs were frequently attacked by Nematode worms and mites, though these might have been attracted to ova that had already been destroyed by other causes.

Larvæ are open to attack by at least two species of ants. In the insectary many wintering larvæ whose cells had been broken during examination were killed and taken by the common black ant (*Pheidole* sp.), whilst in the field on several occasions larvæ of various sizes have been found half devoured in the nests of a red ant (*Dorylus* sp.). It is probable, however, that larval cells are an efficient protection against these marauders, attack only being possible when larvæ are moving through the soil or when a disturbance of the soil fractures their shelter.

An unknown disease accounts for many larvæ. During the field work in 1921, many larvæ were found in the damper soils, apparently suffering from excess moisture. Specimens

were brought to the laboratory, and at the same time large numbers of normal specimens were taken for breeding purposes.

Both the diseased and the apparently normal specimens died in the insectary, all specimens exhibiting the same signs—a darkening of colour in the middle of the body, with a general slate-grey or smoky appearance. Just before death specimens were flabby, and vomitted freely upon being picked up; they were quite inactive. After death the body became of an almost metallic greyish appearance, and the whole of the internal organs appeared to have broken down.

Lands Attacked.—Cultivated lands attacked may be roughly classed as follows:—

A. High red lands, with slight slopes to darker soils; sometimes with "pans" and "basins" of slightly darker and damper soil. Red soils are frequently shallow or stony.

B. Slopes either of narrow valleys, where the gradients are usually steep, or of open vleis, with very low gradients. In nearly all cases these lands ultimately merge into black vleis. Frequently too they possess shallow basin-like pockets of darker wetter soil.

C. Typical black vlei soils found in narrow valleys, with steep slopes, and on the extensive open and slight slopes which usually border the permanent rivers. Sometimes they occur away from rivers, as wide almost level areas with "pans" or "pockets" which become swampy during the rains. These large open vlei lands frequently possess a clayey sub-soil; this adds to their swampy nature.

The valley vlei soils are found in the lowest parts of valleys. Many are divided by wet season spruits, and others possess areas so low that they are swampy even through winter. In such valleys permanently green coarse grasses and reeds are often found. Much of the soil in the middles of these areas is washed away by floods during heavy rains, whilst a portion at least of the soil on the lower slopes is alluvial.

Attacks on the high red lands originate from the migration of adults from lower and wetter areas. This may occur only during or after an abnormally wet season or seasons, in which case breeding will probably take place in the higher soils wherever sufficient shelter occurs. Crops on the lower chocolate soils are open to more frequent and severe attack, since they are nearer the permanent breeding grounds. Migration to such soils takes place in the absence of excessive rains, so long as the beetles emerge in sufficient numbers from the still lower soils. Moreover, many chocolate soils have areas sufficiently moist to allow of breeding except in seasons of drought. The black soils of both the narrow valley vleis and the open vleis are the breeding centres *par excellence*, and crops grown in these areas suffer most. In most vleis the areas already mentioned as being permanently covered with green grass and other vegetation ensure the persistence of the pest even through the driest seasons. In fact, any area which remains moist through the winter affords conditions favourable to its continued existence. Attacks on low-lying lands occur most frequently, therefore, since the pest has actually bred in the lands. Migration is not necessary. It is from these centres that the higher chocolate and red soils become infested.

CONTROL.

(1) **Treatment of Soil or Seed by Adding Deterrent or Poisonous Chemicals.**—It was at first thought that a means of protection might be afforded a crop open to attack by incorporating with the soil a substance that would either deter or poison the adults. In the box experiments lime and arsenic were used in this way, with no apparent effect. Experiments in the field were devised and carried out to test the immunity (if any) from adult injury. Unfortunately, the drought of the year 1922 rendered all the work valueless. It is obvious, however, that vigorous growing plants are abler to withstand attack than weak unhealthy specimens. The addition of fertiliser, therefore, is of benefit in this light. At various times seeds have been treated with Stockholm tar, Coreusine and other deterrents by growers, all to no purpose. It is obvious, of course, that since the beetles attack the young

plants well above the seed, any application to seed of an odorant as a protective measure for the plant is almost certain to be a waste of effort.

Most measures necessitating the purchase of large supplies of chemical substances for the protection of maize crops are likely to be condemned from the start on the ground of expense.

(2) **Protection by Means of a Barrier.**—It was noticed very early in the investigations that where damaged maize crops were divided by a ditch or wet season spruit, destruction often occurred on one side of the ditch and not on the other. This was not always the case, but instances were sufficiently numerous to justify a suspicion that the ditch might possibly act as a barrier to the "trekking" adults, though, of course, it could have no influence on individuals that adopted flight as their means of migration. The one experiment attempted afforded no conclusive evidence, and unfortunately no further work on these lines could be carried out. The question is still in doubt, therefore. The undoubted habits of the newly emerged adults of walking from their breeding grounds on to the neighbouring crop lands also suggested that if the land between such a breeding ground and the maize lands were planted to a crop immune from attack, an efficient barrier to further destruction might be afforded. In several instances, therefore, belts of velvet beans were planted in such areas. The results, though promising, were again inconclusive.

(3) **Immune Crops.**—The food of adults, as already stated, consists essentially of plants of the grass family, and it can be accepted most definitely that any crop other than maize, kaffir corn and the smaller grains and grasses is immune from attack.

The very prevalent practice of producing maize on the same lands for long periods of ten or fifteen years has been of the greatest possible value to the development of the maize beetle, and for many reasons which do not require expression here it is essential that such practices should cease.

Rotation of crops is as essential for the control of insect pests as it is for the conservation of soil fertility. Continuous maize on or near breeding grounds is merely the provision of an ideal and continuous food supply to the very enemy whose

destruction is desired. If maize must be produced on lands near places of breeding, it should not be grown more than once in three years. It has already been suggested that velvet beans ploughed in as a green manure appear to exercise a deterring influence on both adults and larvæ, and in any case they cannot be utilised by the pest for food. This is a most useful crop for many other reasons. Since newly broken grass lands, especially after one or more good wet seasons, are likely to be already infested, first-year maize crops are open to severe damage. It would seem very advisable, therefore, to plant an immune crop on all newly broken lands; this would tend to clear out the pest, and more time would be afforded for a thorough treatment of the soil in preparation for the second season's maize crop.

Instances have occurred where land has been fallowed for one or more seasons, and the succeeding maize crop has suffered severely from beetle attack. In all such cases the lands "fallowed" were simply not cultivated, and produced dense growths of grass and weeds under which the pest established itself. Fallowing will clean a land of beetles so long as weeds and grass are not allowed to grow.

(4) **Date of Planting.**—In the Midlands districts various opinions are held as to the most suitable time to plant maize Many farmers plant in late October or the beginning of November before the rains; others plant immediately after the first rains, and a few wait till the end of November and the beginning of December. Generally speaking, however, the date of planting is determined by the state of progress of the winter preparations—in short, by farm practice. The belief in the advantages of early planting certainly prevails.

The rainfall in October is usually very light and has rarely exceeded 1 inch. By the second week of November, judging from past records, not more than about 3 inches of rain can be expected. Maize planted before the first rains or about the end of October germinates in the first light rains, and by the middle of November with 3 inches of rain the plants reach a height of from 4 to 6 inches. The conditions of moisture and temperature suitable to this germination and growth appear also to provide the necessary stimulus for the

emergence of the adult beetles, and their appearance coincides with this stage of the crop. The invariable result of such coincidence is an attack on the young crop.

The very frequent occurrence of this in the field prompted the suggestion that later planting should be adopted in order to avoid damage, by allowing the newly emerged beetles to start their feeding in the grass veld. Though it is not proven that adults must have green food before oviposition can be commenced, certain it is that they devour it ravenously when within reach; moreover, they travel considerable distances in an instinctive search for their first meal. A well-prepared and absolutely clean land with no crop, therefore, has no attraction whatever for beetles. Individuals finding themselves on such lands waste little time in leaving them for the more salubrious surroundings of the grass veld. By deferring planting until late in November or until after 5 to 6 inches of rain has fallen, such a situation can be created, but it is essential that the land be absolutely free from grass and weeds.

In the field, on many occasions, "accidental" late planting has been the means of avoiding attack in this way. A few instances of purposive late planting have also occurred with similar results. It must be understood, of course, that this is a very general recommendation, and allowances must be made for the vagaries of all local climatic conditions; but if growers plant according to rainfall there should be little difficulty.

It has been objected that on many lands the wet condition of the soil during late November and December makes early planting a necessity. If it is essential to plant maize on such lands, other measures of control must be adopted.

(5) **Winter Treatment of Soil.**—By far the most reliable method of clearing out the pest from a land and of preventing re-infestation is very thorough early winter ploughing, followed by measures designed to break up the soil thoroughly in September and October. There appears to be no reason why the majority of lands in the Midlands should not be ploughed in early winter. Unreaped crops could be stooked, as they are in the northern districts. Such an operation would allow of easy winter working of the soil, and improved production would more than compensate for the extra labour entailed.

It has been shown that in soil first broken in early winter and thoroughly worked in late August and September, larvæ and pupæ of beetles cannot survive, and the more thorough the work the greater the death roll. The presence of beetles is simply testimony to the fact that the land has not been thoroughly worked.

(6) **Drainage.**—The permanent breeding grounds of the pest have already been described; treatment of such areas to render them unfit for breeding is a problem in drainage. Very few attempts have been made by growers to rid their farms of swamps or permanently moist conditions. In many cases such areas are regarded rather as an asset, especially on farms of which the water supplies are scanty or uncertain. On many farms visited, however, the swampy areas are so obviously unnecessary and troublesome that the farmers' policy of tolerance towards them cannot be explained. The majority of such lands could be rendered absolutely innocuous and converted into valuable tracts by simple drainage. The large open vleis appear to be particularly easy of improvement in this way. Until small drainage schemes are carried out many farms will continue to "grow" beetles and suffer accordingly.

(7) **Use of Pigs.**—During the winter months pigs can be turned on to farm lands and allowed to "grub" about on breeding grounds. In one known instance this has been done; and, though the value of their work cannot be estimated exactly, it is most certainly a great check on breeding. In this one case the pigs were herded over the lowest areas of a narrow valley, and in their "grubbing" for roots, astonishingly large areas of soil were most thoroughly turned up. The writer had marked down several spots where breeding was known to be taking place, but in subsequent visits it was found that the soil in these spots had been entirely broken up and no trace of larvæ remained. It is not known by the writer whether or not pigs devour soil grubs; it is reported that they do, but in

any case larvæ have very little chance of surviving the vigorous stirring up of the soil charcteristic of exploration by pigs. In August and September, when even the "wettest" areas are usually passable, it may be possible to pen the pigs on breeding grounds and to move the pens occasionally; in this way a very thorough working over of the soil would be assured.

(8) **Burning of Grass.**—The value of burning as a measure of destruction against developing larvæ was ascertained by experiment. An area known to contain larvæ was well covered to a depth of 6 inches or more with dried grass, maize stalks and other refuse, and this was burned. Examination of the soil immediately afterwards disclosed larvæ at depths of $1\frac{1}{2}$ to 3 inches perfectly healthy.

The emergence of adults after the first 2 and 3 inches of rain places burning as a destructive measure out of the question.

Hand Collection of Adults.—The use of boys for the collection of beetles, though appearing to be at best a temporary protective measure, is likely to have permanent and pronounced results. On several occasions, during serious outbreaks, this method has been adopted by farmers and has saved promising crops from total destruction. That it can be done economically is shown by the following details supplied by two growers:—

Area of lands covered.	Boys per day: average.	Days.	Total cost.
(a) 120 acres	6	7	£2 or £2 10s.
(b) 100 acres (approx.)	9	6	£2 15s.

The first farmer personally supervised his boys, making a start as soon as the presence of beetles was discovered. The whole 120 acres was hand picked twice. In the second instance serious damage had already been inflicted on the crop on the lowest portion of land; the boys were, therefore, concentrated

on the lower slopes of the infested valley, and their continued collecting prevented the spread of the pest up the slopes. On both farms enormous numbers of adult beetles were destroyed. That this greatly reduced the numbers for the following season, of course, is obvious.

SUMMARY OF CONTROL MEASURES.

The most completely satisfactory control measures recommended are mainly cultural, and comprise the following:—

(*a*) Thorough ploughing and breaking up of soil as soon as possible after the last crop and as frequently as possible during the winter. This operation is especially valuable if continued during late August, September and October.

(*b*) Later planting of maize. The date of planting should be determined by local conditions, and special attention should be paid to rainfall. This measure will be of no value in avoiding attack unless the land concerned is kept entirely free from grass and weeds during late October and November.

(*c*) Drainage of vlei areas. This is an essential work if the low-lying damp permanent breeding grounds are to be eliminated. It is admitted that difficulties will occur in connection with many such areas, but there is no doubt that where such difficulties can be overcome, the results in most cases will more than justify the expenditure. The type of wide open vlei land is particularly easy to drain and render unsuitable for breeding.

(*d*) Rotation of crops. The value of this is generally admitted by growers; it is only necessary to emphasise the fact that the production of the same crop on the same land over a succession of years, as practised by Rhodesian growers, is a direct invitation to all the specific insect and fungus pests of that particular crop to feed and breed.

(*e*) The running of pigs on vlei lands during winter. This is particularly helpful in connection with wet lands that cannot be treated with the ordinary farm implements.

(*f*) Fertilising. To provide a tonic to crops is to produce healthy vigorous plants that "get away" quickly from the young delicate state, and so to some extent avoid the danger to which all young growth is exposed.

(*g*) Hand collection of adult beetles. It can be stated most definitely that this can be carried out quite economically, and serves a most valuable purpose in checking damage to a crop, besides being a very certain method of reducing the risks for following seasons.

All these measures have been discussed somewhat fully. They, or at least the majority, can be carried out by all growers, and their adoption will most certainly prove of very great value. Rhodesian growers are loth to change their methods. There is nothing revolutionary in these recommendations, however; the substance of the whole is merely "better farming."

Three Types of Water Tank.

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The following article describes three types of storage tank, designed to make use of materials and building methods that are usually readily obtainable on farms in this Colony, without using specially skilled labour. It is considered that the designs are cheap and simple enough for construction under farm conditions, and more durable than the ordinary corrugated iron tank, which is also more expensive to erect in the larger sizes (over 5,000 gallons).

The tanks can be built in a variety of sizes, varying in capacity from 5,000 or 10,000 gallons to 30,000 gallons, and are suitable for a number of different purposes, such as domestic water supply, watering stock or irrigation on a small scale. The designs have been made as simple as possible, but it must be clearly understood that sound workmanship and good materials are essential if the results are to prove satisfactory.

The choice of the type of tank will depend on the local conditions and requirements. The reinforced brick tank, for instance, can be built where the tank is required to stand entirely above ground-level, while using a minimum quantity of bricks and cement. It can be combined with a circular trough for watering cattle. Very sound, well burnt, bricks are essential for building a tank of this type. The second tank (Fig. 3) requires to be built partly underground and is therefore suitable for situations on rising ground. The brick-laying in the walls is a straight-forward job, and no re-inforcement is used except at the corners. A greater quantity of bricks and cement is required than for the circular tank, owing to the thicker walls. This type of tank may also be built in stone. The third tank (Fig. 4) consists of a corru-

gated iron wall and a concrete floor, and may be found useful in parts of the country where it is impossible to make good bricks.

The tanks have been designed to suit normal, straightforward conditions, but in cases where exceptional requirements are to be met, it is advised that special advice should be sought from the Irrigation Division, Agricultural Department.

CIRCULAR RE-INFORCED BRICK TANK.

A brief set of specifications for building this tank was published in the *Rhodesia Agricultural Journal* in April, 1930, and was reprinted as Bulletin No. 780. Certain features of the design have since been revised and improved.

Fig. 2.

General Description.—The tank is 6 feet high, and consists of a circular 9 inch brick wall, which is re-inforced to resist the bursting pressure of the water by rings of No. 8 gauge wire, built into the vertical joints of the brickwork and not in the horizontal mortar joints. The drawing (Fig. 1) shows the details of the design and the photograph (Fig. 2) shows the tank in course of construction.

The Foundations.—The bottom of the foundation trench must be perfectly level and in good compact soil. The foundation consists of not less than 6 courses (1′-9″) of 14 inch brickwork, the two upper courses of which are each re-inforced with 2 turns of No. 8 gauge high tension galvanised wire, wound round the inner row of bricks, as shown in Fig. 1. Care must be taken that the wall is of the diameter required, and that it is truly circular. The setting out of the circle is described in the next paragraph.

The Wall.—The wall consists of 21 courses laid in series of 3 courses of stretchers and 1 course of headers. The method to be followed in laying the bricks is as follows:—the inner stretchers of 3 courses are laid first, and then encircled by the correct number of turns of No. 8 gauge wire. For instance if 8 turns of wire are required (see Fig. 1) the winding (commencing from the bottom) consists of 4 turns of wire made in an upward direction and 4 turns in a downward direction, so that the two ends meet and can be joined together at the bottom. The turns should be spaced as evenly as possible. The two ends should be joined by slipping over them a "ferrule" (a coil of tightly twisted baling wire about 2 inches long) and bending the free ends back. The wire must otherwise be kept free from bends and twists, and be wound on firmly, but not strained, and particular care must be taken not to damage it when making the joint. The best method of winding is to use a home-made spool, revolving on an axle of iron rod, and carried on a framework with four handles (like a miniature stretcher). This is carried round and round the tank by two boys, paying out the wire as they go, while the builder guides it to its proper position on the tank, and keeps it taut.

When the wire has been secured, the three courses of outer stretchers must be laid, one course at a time. The vertical joint between the inner and outer stretchers (in which the wires lie) must be solid and well trowelled in, taking care to work the mortar in behind the wire if at any point it stands away from the bricks. A course of headers is then laid on top of the three courses of stretchers, to bind the wall together.

This arrangement of three courses of stretchers followed by one course of headers is continued to the top of the wall, as shown in Fig. 1.

A simple and accurate method of building the wall truly circular and vertical can be seen in the photograph Fig 2. A 2 inch pipe (about 11 feet long) is firmly set up at the centre of the tank and held by 3 wire "guys," which are adjusted until the pipe is truly vertical. A light wooden framework is then made to reach to the inside of the wall, pivoting on the pipe by means of hoop-iron straps. A "bearing" surface can be arranged to carry the weight of the framework by using two lengths of pipe joined by a socket level with the top of the wall. One of the hoop-iron straps is then arranged to rest on top of the socket.

The sloping top member of the framework can be used to adjust the "hang" of the sweep so that the outer edge is truly vertical. The sweep is then rotated as a constant guide to the laying of the bricks.

All brickwork in the wall and foundation is to be laid in a mortar consisting of not less than 1 part of cement to 4 of sand, or alternatively 1 part cement to 5 sand plus ½ part "lime paste" mixed as described in the paragraph describing "The walls" of the Rectangular Brick Tank. The bricks are to be thoroughly soaked in clean water immediately before being laid. The bricks should be carefully examined and any cracked, badly burnt or unsound bricks must be rejected. The horizontal joints on the inside of the wall are to be raked out to the depth of ½", as the work proceeds, to give a key to the plaster. Since the outside of the wall is not to be plastered, the joints should be neatly struck.

Plastering.—The inside and top of the wall are to be plastered with 1.3 cement mortar not less than half an inch thick and finished with a smooth uniform surface. The brick surface should be thoroughly wetted before the plaster is applied, and the whole of the plastering completed in one day.

When the plastering is completed, it should be covered with wet sacks and kept continually damp for seven days.

The Outlet Pipe.—Where an outlet pipe is required (it may not be wanted if a circular trough for cattle is to be built round the tank) it may be arranged in either of the two ways shown in Fig. 1. The pipe is laid in a trench below floor-level and passed loosely through an opening in the foundation wall. The trench is then back filled with earth, well rammed down. The attachment of the outlet valve and the building of the valve chamber should be done before the floor of the tank is laid, in order to avoid cracking the floor by any movements of the pipe. The "stop flanges" shown in the drawing set in concrete are to prevent leakage along the line of contact between the pipe and concrete. The pipe should be carefully cleaned of all oil or grease where it is to come into contact with concrete or mortar.

The Floor.—The floor may be made either of brick or concrete. If of brick, great care must be paid to the laying of the bricks to ensure that the joints are wide enough to receive the "grout" and that the "grout" is properly worked in. In either case the surface on which the floor is to be laid must be thoroughly and uniformly hard. If there is any doubt on this point, the soil to the depth of 4 inches should be excavated, and a bed of "hard-core," mixed with veld sand to bind it, should be laid and rammed solid. The bed should be thoroughly wetted before the floor is laid.

The edge of the floor should be level with the top of the foundation wall, from which it is graded down uniformly to the outlet pipe opening (a fall of at least 1 inch should be allowed).

For a brick floor a plaster coat of 1:3 cement should be applied uniformly and quickly as soon as the floor is laid. The floor should be thoroughly soaked with water before plastering.

For a concrete floor, the stone should be broken small, not more than 1 inch in its largest dimension. The floor must be laid in one day without a stop, and should be tamped down, and left with an even surface as it is laid, and should not be plastered. If the method of setting the one end of the outlet

pipe in a solid block of concrete is adopted, the block should be cast, in a neatly excavated hole, continuously with the floor, without a joint.

When the floor, either brick or concrete, is complete, it must be covered with wet sacks or grass, and kept continuously damp, to "cure" for seven days.

At the edge of the floor next to the foundation wall, a continuous V-shaped groove should be left open. If the tank can be filled immediately, the curing of the floor can be discontinued after three days, and the V-joint sealed as follows.

Any water in the groove must be mopped out, and the moisture on the surface dried off with a plumber's blow lamp. While this is being done, the pitch should be heated in a paraffin tin until it is quite fluid, and while the groove is still warm the pitch should be poured into it with a bailer consisting of a tin (about the size of a 2 lb. jam tin) to which a handle has been attached. A thin layer of pitch should be poured all round the groove, and the blow lamp should be played on it as it is poured so that it will adhere to the cement. It may be necessary to go round the tank two or three times with pitch and blow lamp until the groove is sufficiently full. The tank can then be filled immediately. If the tank is "cured" for the full seven days or longer, the groove must be sealed and the tank filled as soon as the curing is discontinued, so that the cement work does not have a chance to dry out.

The advantage of making a definite V joint filled with pitch is that a flexible, water-proof joint is obtained at the angle between wall and floor, a point at which otherwise there is always the risk of a crack developing.

In the case of an open sump being made for the outlet pipe (see Fig. 1) a V groove should be left along the junction of the floor and the walls of the sump, and sealed with pitch in the same way as described above.

Overflow Pipe.—An overflow pipe, long enough to prevent water dripping on to the foundation, should be fitted, as shown in Fig. 1.

CATTLE DRINKING TROUGH.

If required, a trough can be conveniently built round the circumference of the tank. The interior of the trough should be carefully plastered. A section of a suitable trough is shown in Fig. 1.

The supply of water into the trough is best regulated by means of a 1 inch pipe passing through the wall of the tank and fitted with a ball-valve floating on the surface of the water in the trough, as indicated in the drawing. The valve and pipe must be enclosed in a brick chamber (with openings into the trough on each side) and covered over with an iron plate which should be hinged and padlocked to prevent tampering.

Roof.—Where the tank is intended for domestic water supply or is situated near a house, it will be desirable to provide a mosquito proof roof. Owing to the expense of reproduction no drawing of a roof will be published with this article, but advice and plans can be obtained on application to the office of the Irrigation Division (P.O. Box 387, Salisbury, or P.O. Box 566, Bulawayo).

Quantities of Materials.—The following tables show the approximate quantities of the principal items required for tanks of different sizes using either a brick or a concrete floor:—

A.—With Brick Floor 4½ inches thick.

Item.	10,000 gal. tank.	15,000 gal. tank.	20,000 gal. tank.
Bricks	6,400	8,400	9,900
Cement...	26 bags	34 bags	42 bags
Sand	7½ cu. yards	10 cu. yards	12 cu. yards
Wire No. 8 ...	750 yards	1,050 yards	1,360 yards
Pitch	30 lbs.	38 lbs.	44 lbs.
Aproximate cost of materials	£21 10 0	£28 7 0	£34 18 0

B.—With Concrete Floor 4 inches thick.

Item.	10,000 gal. tank.	15,000 gal. tank.	20,000 gal. tank.
Bricks	5,100	6,400	7,300
Cement...	28 bags	37 bags	46 bags
Sand	7½ cu. yards	10 cu. yards	12 cu. yards
Broken stone ...	3½ cu. yards	5 cu. yards	7 cu. yards
No. 8 wire	750 yards	1,050 yards	1,360 yards
Pitch	30 lbs.	38 lbs.	44 lbs.
Aproximate cost of materials	£23 0 0	£30 0 0	£37 12 0

The above quantities are "nett," and allowances should be made for waste, particularly for bricks and sand.

The figures of cost given above do not include any piping and are based on the following costs:—Farm-made bricks @ 10/- per 1,000, cement 12/- per bag, sand 2/- per cubic yard, broken stone @ 5/- per cubic yard, wire @ 4/- per 100 yards, pitch @ 4d. per lb.

Cattle Trough.—The following list shows the quantities of materials required to build a trough of the type shown in Fig. 1 *completely surrounding* the various sizes of tank:—

Item.	10,000 gal. tank.	15,000 gal. tank.	20,000 gal. tank.
Bricks	3,300	3,900	4,400
Cement...	14 bags	17 bags	19 bags
Sand	3¼ cu. yards	4½ cu. yards	5 cu. yards
Aproximate cost of materials	£10 16 0	£12 12 0	£14 2 2

In addition a short length of 1 inch pipe, and a ball-valve is required for each trough.

The full lengths of the troughs if completely round the tanks, would be 69 ft., 83 ft. 6 inches, and 94 ft. respectively, but there is no necessity for them to extend the full circumference and they may be reduced, if desired, to suit particular needs.

RECTANGULAR BRICK TANK.

A rectangular tank cannot safely be built above ground level unless the walls are re-inforced or are of great thickness. For this reason a brick tank of square or oblong shape is best built partly below ground-level in order to obtain the support of earth pressure. The square shape is more economical than the oblong because it has the greatest capacity for a given total length of walls. The actual thickness of wall does not permit of exact calculation, but the size shown in the drawing (Fig. 3) will be suitable for soil of average firmness, which does not contain too much clay. Generally speaking, the wall should not exceed 30 feet in length.

Tanks of this type are suitable for sites on sloping ground where the outlet pipe or channel can be brought out to the surface in a short distance. Sites where the soil is heavy clay or is boggy and damp should be avoided.

The Excavation should be carefully measured off, and finished with vertical sides about 5 inches beyond the edges of the wall. The bottom of the foundation trench should be perfectly level. No hollows or soft patches should be left in the bottom of the excavation. The excavated earth should be thrown well clear of the edges of the excavation. The reason for this will be explained later.

The Walls consist of 18 inch brick footings, 3 courses in thickness, and 14 inch walls carried up to the highest ground level, on top of which 9 inch walls are built for the remainder of the height of the tank (not more than 3 feet). The bricks should be well burnt and sound, and should be thoroughly soaked in water immediately before being laid. The mortar should consist of 1 part of cement to 4 of sand, but if preferred, a mortar composed of 1 part cement plus ½ part lime paste to 5 of sand may be used. This mixture requires 1 bag of quick lime to every 6 bags of cement. The addition of lime makes a somewhat lean mixture more workable and water tight. The lime paste is prepared by soaking quick lime in water for at least two weeks, and then straining it through a fine sieve to remove any solid particles which may not have decomposed. The lime paste is mixed to a thin cream and

added to the other ingredients with the first mixing water. A rather stiff mortar should be used, as the bricks have been previously wetted.

Re-inforcement of Corners.—The weak point of any rectangular structure is the corner. To prevent cracking at the corners it is advisable to build in some type of re-inforcement, at any rate above ground-level. A convenient way of doing this is shown in a perspective view in the drawing (Fig. 3). Hoop-iron (1 inch wide) is cut into lengths of 6 feet and hammered over in the middle to form a right angle. These pieces are built in pairs (arranged as shown in the drawing) into every second course of brick work. Greater strength can be obtained by bending each end for a few inches down into the vertical joints of the wall.

Plastering.—The inner surfaces of the walls only are to be plastered with 1 : 3 cement mortar and the work should be done in accordance with the remarks made under this heading in the description of the circular re-inforced tank.

The Outlet Pipe should pass through the wall on a level with (or slightly below) the top of the foundation wall. The end of the pipe should have a stop flange screwed on to it, and should be set in a block of concrete (1 : 3 : 5) 10 inches deep and 14 inches wide. The end of the pipe should be set back about 3 inches into the thickness of the wall and the concrete moulded to give a curved entrance. The floor should be laid with a slight slope towards the pipe entrance, so that the tank can be completely emptied for cleaning purposes.

The pipe should be laid in a trench sloping 1 inch in every 5 feet towards the outlet, and the work of fixing the outlet valve, building the valve chamber and filling the trench (which should be well rammed) should be completed before the concrete block is cast in the wall. The ends of the pipe should be well cleaned of any oil or grease.

The Floor may be either of 1 : 3 : 5 concrete (4 inches thick) or brickwork 4½ inches thick and should be laid in accordance with the instructions given under this heading in the description of the circular re-inforced tank.

The Earthwork.—Since the stability of the walls depends to a large extent on the support of the surrounding earth, it is very important that the earthwork should be solid and rammed hard. The space between the 14 inch wall and the sides of the excavation should be back filled a few inches at a time as the wall is built, and rammed solid and hard. When the brick-work is complete, the earth bank should be thrown back against the 9 inch wall and for a distance of at least 18 inches adjacent to the wall it should be rammed particularly hard, in layers not more than 6 inches thick. When ramming earthwork near the walls, care must be taken that it is not done so violently as to disturb the joints of the brickwork. The bank should then be finished off neatly with a level top 3 feet wide and an even slope on the outside. The dimensions of the bank shown in the drawing are such that the volume of earth in the bank will balance the volume of excavation taken out for the tank.

The Overflow Pipe, which must, as a rule, be bigger than the pipe supplying the tank, should be set a few inches below the top of the wall in a concrete block 7 inches deep by 9 inches long. It should slope gently outwards and extend to the edge of the top of the bank. A V-shaped brick and cement channel should be built to carry off the water to the foot of the bank.

The Outlet Works will depend on the purpose for which the tank is intended. If for irrigation, the scheme shown in the drawing may be adopted. A 9 inch head wall should be built at the head of the open channel if the depth exceeds 3 feet. The bottom of the channel should be lined with brick if the water has to be led for any distance to avoid waste of water through seepage. The sides of the channel should be cut back to a slope of at least ½ to 1, and not left vertical. The outlet pipe should be not less than 12 feet long.

Quantities of Materials.—The following tables show the approximate quantities of the principal items required to build square tanks of various sizes, with either brick or concrete floors. Somewhat greater quantities will be needed for oblong tanks, of the same capacity.

A—With Brick Floor 4½ inches thick.

Item.	10,000 gal. tank.	20,000 gal. tank.	30,000 gal. tank.
Bricks	7,500	11,000	14,500
Cement...	31 bags	47 bags	63 bags
Sand	9 cu. yards	12½ cu. yards	17 cu. yards
Hoop-iron	240 feet	240 feet	240 feet
Pitch	35 lbs.	49 lbs.	62 lbs.
Aproximate cost of materials	£24 15 0	£36 14 0	£49 0 0

B—With Concrete Floor 4 inches thick.

Item.	10,000 gal. tank.	20,000 gal. tank.	30,000 gal. tank.
Bricks	6,300	8,600	10,700
Cement...	32 bags	49 bags	67 bags
Sand	9½ cu. yards	13 cu. yards	17½ cu. yards
Broken stone ...	3½ cu. yards	7 cu. yards	11 cu. yards
Hoop-iron	240 feet	240 feet	240 feet
Pitch	35 lbs.	49 lbs.	62 lbs.
Aproximate cost of materials	£25 11 0	£38 8 0	£51 18 0

The costs quoted in the tables above are calculated on the same basis as for the circular re-inforced brick tank, and do not include any piping.

Use of Stone Masonry.—In situations where good building stone (such as the flat slabs of granite often found on "dwalas") is avilable within a reasonable distance, the walls of the rectangular tank may be built in stone masonry. The lower half of the wall should then be not less than 15 inches thick, and upper half 12 inches thick. The masonry should be laid as regularly as possible in courses, and no vertical joint should be allowed to extend more than two courses in height. Given good building stone of regular shape, some saving in cement can be made.

CORRUGATED IRON TANK WITH CONCRETE FLOOR.

The ordinary corrugated iron tank requires the services of a skilled workman to erect it on the site, and do the necessary riveting and soldering. The composite tank which will now be described consists of a circular corrugated iron wall, supplied by the makers in sheets marked and numbered, so that they can be assembled and bolted together by unskilled labour. A concrete floor is cast inside the tank, and the whole job can safely be undertaken by the farmer, without specially skilled assistance. The scheme has already been worked out and put into practice by a Rhodesian firm of sheet-metal-workers, and the design illustrated and described in this section of the present article is merely an alternative method of constructing the tank and floor, which may be preferred in certain circumstances.

The design is illustrated in Fig. 4. The depth of the tank has been increased to 8 feet (4 rings of iron) in order to economise in concrete, by reducing the floor area in comparison with the brick tank previously described. When ordering the tank, allowance should be made for the fact that the height of the outlet pipe above the bottom of the iron (about 6 inches) and the depth of the overflow pipe below the top of the iron (about 4 inches) will reduce the effective depth of the tank. For this reason the capacities of the tank shown in the drawing are only "nominal." 22 gauge iron may be used for tanks up to 20,000 gallons capacity, but for larger tanks 20 gauge iron should be used.

The iron sheets should be supplied by the makers ready bent, punched and numbered, together with the necessary bolts, a sufficient quantity of some type of packing for the joints, and some kind of bitumastic compound for painting the inside of the tank and for coating the packing of the joints. Rings of $1\frac{1}{2}'' \times 1\frac{1}{2}'' \times \frac{1}{8}''$ angle iron are required to stiffen the top and bottom of the tank, and the makers should supply the angle-iron in lengths, curved, drilled and marked complete with bolts to secure the rings to the corrugated iron, and fish-plates to join the lengths of angle-iron together. Full instructions for erecting the tank should be supplied by the makers.

Erecting the Tank.—It is important that the floor should rest on a surface which is uniformly hard and solid. For this type of construction it will be advisable not to attempt to make up a bed at the ground surface, but to excavate to a depth of 12 inches, as shown in Fig. 4. The bottom of the excavation should be carefully levelled, and rammed solid. If there is any doubt about the soundness of the foundation, the excavation should be carried 4 inches deeper, and a layer of "hard-core" laid and well rammed (as described in the section of this article under "Re-inforced Brick Tanks"). The edge of the excavation should be cut neatly in a true circle, 18 inches larger in diameter than the diameter of the tank.

The tank should then be erected in the centre of the excavation, so that a space of 9 inches is left between the iron and the edge of the excavation. The outlet pipe connection should then be made, the pipe being laid in a shallow trench, afterwards filled in and rammed. This completes stage 1 of the construction (see Fig. 4).

Inside the tank a number of iron pegs or wooden stakes should be driven into the ground at intervals of about 4 ft. These stakes should be placed so as to hold the tank firmly at the bottom and on a true circle, measurements being made from a peg at the centre. The space between the tank and the edge of the excavation should then be filled with concrete ("Stage 2," Fig. 4). The concrete should be mixed in the proportions of 1 cement: 3 sand, 6 stone, and should be worked into close contact with the angle-iron ring and the corrugations. The top surface of the concrete should be finished with an outward slope. The concrete should be covered with sacks or grass, and kept continuously wet for seven days. The stakes inside the tank should not be removed until the day after placing the concrete.

The Floor.—The floor of the tank can now be laid. The floor consists of a 4 inch layer of concrete, mixed in the proportions of 1 cement: 3 sand: 5 stone, with $\frac{1}{2}$ part of lime-paste added to improve the water tightness. A description of the method of preparing the lime-paste has been given in the paragraph describing the walls of the "Rectangular Brick Tank."

The floor should be laid as quickly as possible, and well rammed to consolidate the concrete. At the junction of the iron wall of the tank a groove should be made by trowelling the fresh concrete away from the iron. This groove should not be more than 1½ inches wide by 2 inches deep.

When the floor has been laid, it should be properly "cured," and the groove "sealed," all as previously detailed in the description of the " Re-inforced Brick Tank."

Outlet Pipe.—The type of connection shown in the drawing (Fig. 4) is the one generally used for corrugated iron tanks, the pipe being screwed into a cast-iron corrugated flange, but, if preferred, the pipe may be laid under the floor in the same way as with the circular brick tank (Fig. 1). The advantage of this method is that a greater amount of the storage capacity of the tank is available. The pipe trench should be as narrow as possible, and the earth rammed in solid to avoid the unequal settlement of the floor. All work in connection with the outlet pipe should be completed before commencing the erection of the tank itself.

Quantities of Materials.—The following table shows the quantities of materials required for the floors of the tanks of various sizes. To them must be added the piping and the fittings to suit each individual case, and the tank itself, quotations for which should be obtained from a reliable firm of sheet-metal workers.

Item.	10,000 gal. tank.	20,000 gal. tank.	30,000 gal. tank.
Cement...	11 bags	19 bags	22 bags
Lime...	1 bag	2 bags	3 bags
Sand	2½ cu. yards	4½ cu. yards	6 cu. yards
Stone	5 cu. yards	9 cu. yards	11 cu. yards
Approximate cost of material	£8 11 10	£14 15 0	£20 6 0

Aloe ferox.

Alte Davyana.

Aloe pluridens.

Notes on African Aloes.

By H. Basil Christian, Ewanrigg, Arcturus.

PART XI.

Aloe Davyana.—*A. davyana* occurs on the hills round Pretoria, Transvaal, on quartzite formation. It is one of the stemless spotted leaf aloes with a neat compact habit of growth, somewhat similar in general appearance to *A. harbertoniæ* when not in flower. The under sides of the leaves are unspotted and the margins have a distinct brown cartilaginous border armed with sharp brown teeth. Owing to the pale colour of the flowers the inflorescence is not very showy. Plants kindly sent by Dr. Pole Evans from Meintjes Kop in 1932 flowered at Ewanrigg in May, June, and July, 1933. Up to the present they have shown no signs of suckering.

Description.—An acaulescent plant. Leaves 12-20 in a dense rosette fleshy rigid, usually withered at the tips, about 22 c.m. long, 8 c.m. broad at the base, and 1.5 c.m. thick, ovate-acute, slightly concave on the upper surface, lineate, green with a brownish tinge above, with greenish-white spots arranged in irregular transverse bands. The spots confluent towards the base, convex below, pale green and unspotted, more-or-less lined with dark green longitudinal lines; margins with a distinct brown cartilaginous border sinuately toothed with brown deltoid, pungent, spreading teeth about 5 mm. long and 10 mm. apart. Inflorescence one or more from the same rosette up to 0.75 m. high, simple or branched, ending in somewhat lax elongated conical racemes about 22 c.m. long, the end one up to 27 c.m. long, the mature flowers pendulous. Peduncles sub-terete from the base bearing a few empty membranous bracts up to 5.5 c.m. long and 6 mm. broad at the base; the branches subtended by long narrow membranous bracts up to 8.5 c.m. long; floral bracts ovate-cuspidate up to 16 mm. long clasping the lower part of the pedicel; pedicels about 27 mm. long. Perianth about 3.5 c.m. long, the base usually distinctly rounded and pale green,

swollen over the ovary to 7 mm. diameter, thence constricted to 5 mm. and ampliated towards the middle to 9 mm. on the one axis and laterally compressed to 6 mm. on the other, slightly decurved; segments about one third the length of the perianth, pink shading to white at the margins, faintly 5-nerved, inner segments white shading to yellow at the apex, with a broad pink median line; stamens included or at length exserted, greenish yellow; style as long as the stamens, yellow; ovary 8 mm. long, 3.5 mm. in diameter.

Aloe Ferox.—A. ferox is one of the aloes sent to Holland by Governor van der Stel in 1701-02 and was described by Caspar Commelin in his *Praeludia Botanica* in 1703. It is widely distributed over the south-eastern parts of the Cape from Swellendam to Pondoland and occurs in several varieties. From this aloe is obtained the drug of commerce, Bethelsdorp, near Port Elizabeth, and Mossel Bay being the centres of the industry. It is one of the arborescent aloes with a stout stem 8-12 ft. high, the variety illustrated being the handsomest. The colouration of the flowers varies considerably in different plants, through shades of orange and red. The stamens, which are red, project considerably beyond the perianth.

Description.—An arborescent plant with a stout stem up to 3-4 m. high, simple. Leaves in a dense rosette from 0.5 m. to 1 m. long, 10.5 c.m. broad below and 15 mm. thick tapering from the base to the apex, bi-convex in cross section towards the base, concave above on the upper surface, convex on the lower surface; margins armed with stout, brown, deltoid, horny prickles, about 5 mm. long, and 10-15 apart, interspaces straight, usually with one or two small prickles on the lower surface at the apex. Inflorescence branched. Racemes erect, very dense, up to 60 c.m. long. Peduncles strongly laterally compressed below, branches somewhat sparsely clothed with ovate-cuspidate, empty membranous bracts; floral bracts ovate-cuspidate, many nerved, 6.5 mm. long and 5 mm. broad; pedicels short up to 5 mm. long. Perianth 26 mm. long, 5 mm. in diameter at the base, ampliated to 9 mm. towards the middle and gradually constricted to 7 mm. at the throat, colour orange; segments connate at the base, 6 mm. broad, 3-nerved, inner segments 10 mm. broad, obtuse, yellow, with a three-nerved flesh colour median line shading

to brown at the apex; stamens projecting 17 mm. beyond the perianth; included portion terete, yellow, exserted portion ampliated and laterally compressed, red; anthers terracotta; style as long as the stamens, yellow.

Aloe Pluridens.—*A. pluridens* is one of the collection sent to Kew by Bowie between 1817 and 1830. It is one of the arborescent aloes with an unbranched stem up to 12.0 ft. high. The leaves and inflorescence bear a strong resemblance to those of *A. arborescens*. It occurs at Stinkpoort, in the Uitenhage Division of the Eastern Province of the Cape, and at Boschberg, in the Somerset Division. Under Southern Rhodesian conditions, where it flowers in May, June and July, it is very slow growing. It throws out suckers from its stem, but plants grown from these take 5-7 years before they flower under our conditions.

Description.—Arborescent, up to 4.0 m. high below the rosette of leaves, stem simple, from 10-15 c.m. in diameter. Leaves in a dense rosette, up to 60 c.m. long, 5 c.m. broad and 6 mm. thick, tapering gradually from the base to the apex, slightly falcate and recurved, flat or slightly convex on the lower part, concave above, green, unspotted, obscurely lineate, the lower surface convex; the marginal prickles deltoid, white tipped, 4 mm. long and up to 7 mm. apart, usually curved forwards. Peduncle simple or branched up to 58 c.m. long, including the inflorescence, more-or-less clothed with deltoid, empty membranous bracts about 15 mm. long; raceme conical, dense up to 20 c.m. long. The mature flowers pendulous; floral bracts deltoid, about 15 mm. long and 6 mm. broad; pedicles about 30 m.m. long. Perianth cylindrical 45 mm. long, yellowish red, segments conate at the base; stamens included or exserted, yellow, usually at length withdrawn into the perianth; style exserted; ovary yellowish green, 8 mm. long and 3.5 mm. in diameter; capsule 20 mm. long and 11 mm. in diameter, reddish-brown.

Southern Rhodesia Ground Nuts.

FURTHER REPORT BY IMPERIAL INSTITUTE, SOUTH KENSINGTON, LONDON.

The nine samples of ground-nuts which are the subject of this second report were forwarded to the Imperial Institute by the Chief Division of Plant Industry, Southern Rhodesia.—Ed.

Regarding the market in this country for ground-nuts for edible purposes, we subsequently received similar enquiries from other Empire countries where the growing of superior quality ground-nuts for export to this country is under consideration, and in view of the possibility of additional supplies becoming available from these sources as well as from Rhodesia, it was considered desirable to re-examine the market possibilities. We have accordingly made further enquiries among firms specially interested in ground-nuts of this quality and the information obtained is given in the attached memorandum.

It has proved impossible to obtain any information as to the total quantity of superior ground-nuts for edible use which are imported annually into the United Kingdom, and trade opinions differ somewhat widely as to the extent to which the imports might be increased. You will find that one firm considers the additional supplies of 250 to 300 tons might be absorbed without spoiling the market. A second firm, specially interested in ground-nuts for dessert purposes, thought that their branch of the trade could take 500 tons more per annum but that the price might be slightly affected by this increase. A third firm, who supply nuts to the confectionary trade and for dessert purposes as well as to greengrocers and for the barrow trade, were of the opinion that an additional 500 tons would not be likely to have any detrimental effect on prices. A fourth firm, with somewhat similar interests to the last mentioned, took a less hopeful view, as in their opinion there

would be a distinct danger of over-stocking the market if large additional supplies were forthcoming; they did not anticipate any appreciable increase in the demand for ground-nuts for edible purposes and considered that only limited quantities of the Rhodesian nuts could be marketed here in competition with supplies from other countries which are already producing. The trade opinions, taken as a whole, indicate that a market could be found here for consignments of superior ground-nuts from Southern Rhodesia. In view, however, of the established sources of supply and of the possibilities of other Empire countries starting the cultivation of this type of ground-nuts it would be unwise to develop the production too quickly. The best course to pursue would be to proceed with the production of the high-grade nuts on a moderate scale, and gradually to develop the trade to a maximum figure depending on future market conditions. A production of 500 tons per annum would be much too large in the first instance. In this connection it would apparently be advantageous if the production were not restricted to a particular variety. There appears to be a good demand for Spanish Bunch, both in shell and in kernels, and this variety might be grown to the largest extent. The kernels of the other varieties, *viz.*, Masumbika, Virginia Bunch and Jumbo, would also be marketable for confectionery purposes, and in the shell would be suitable for barrow trade.

If you could send us representative samples of any bulk consignments of the nuts which may be produced in Southern Rhodesia we shall be glad to submit them to these firms with a view of obtaining definite offers.

It is hoped that this information will be of service. The Imperial Institute will be glad to be kept informed of the progress of ground-nut cultivation in Southern Rhodesia and to be of any further assistance which may be possible.

THE MARKET FOR EDIBLE GROUND-NUTS.

The following statement summarises the views of firms in the United Kingdom on the general question of the market for edible ground-nuts and on the possibility of disposing of additional supplies from Southern Rhodesia.

(1) This firm furnished the following opinion with special reference to the enquiry as to whether a quantity such as 10,000 cwt. of superior nuts in the shell might reasonably be exported from Southern Rhodesia:—

"We do not think it wise to encourage over 250/300 tons in present markets. We do not like giving opinions under present world conditions, as any small factor may increase the selling outlets. Whilst we figure 250/300 tons as a fair quantity, without unduly spoiling market, you will appreciate that we cannot guide you fully without knowing c.i.f. cost."

They mention that some superior ground-nuts in the shell have been sold this year at £28 10s. spot, London.

(2) A second firm, who are specially interested in ground-nuts for dessert purposes, reported as follows:—

"There is a very good market here for superior quality ground-nuts in shell for edible purposes. The supplies at present come from Spain, China, India, respectively, as to quality. The biggest quantity imported come from China, but these, whilst being very satisfactory, are the lowest price."

Samples of the Rhodesian ground-nuts were submitted to the firm, who expressed special interest in the Spanish Bunch variety for dessert purposes. They consider that the current price in London of these nuts in the shell would be about 24s. per cwt. c.i.f., provided that the colour of the shells is at least as good as that of the sample washed in sand. The kernels would have to compete with Toeban ground-nut kernels from Java, which are now realising about 14s. 6d. per cwt. c.i.f.

The firm expressed the view that the market could absorb an additional 500 tons per annum of these nuts, but that such a quantity might affect the price to a slight extent.

(3) A third firm stated that most of the ground-nuts they sell are used in the confectionary trade or for dessert, but they also supply smaller quantities to barrow merchants and greengrocers. The chief variety they buy are Chinese hand-picked selected kernels and Toeban Javan kernels, but smaller quantities of Chinese h.p.s. nuts in shell are also purchased.

For use in the better class of confectionery the kernels are employed and the skins removed, whilst for the cheaper kinds of toffee, etc., the skins are left on. For the better-class trade Chinese h.p.s. kernels are used and for the second-class goods other sorts. The kernels are imported in bags containing about $1\frac{1}{2}$ cwt. The tint of the red skin is not of importance.

The firm manufacture salted ground-nuts for dessert purposes. Chinese h.p.s. kernels are used for this trade and are roasted and blanched. Here, again, the tint of the skin is not of importance. For kernels to be used in the raw, unroasted state for dessert purposes, the Toeban Javan kind is used. For this purpose the kernels should have pinkish skins, so that in this case the colour of the skin is important. Kernels with darker skins can, however, be employed in limited quantities.

For the barrow trade the shells must be clean and of light colour, and when roasted must retain their good appearance. The shade of colour of the skins is not important. More than two kernels a nut is not an advantage, but the larger the nuts are the better, as the barrow merchant buys them by weight and sells them in volume. The firm buy Chinese h.p.s. nuts in shell for this trade. Such nuts are usually imported in bags containing 80-100 lb.

The greengrocery trade is only a small line of business. Ground-nuts in shell are sold for this purpose, and are not roasted. The shells must be clean and of light colour. The tint of the skins is not of importance. The firm use Chinese h.p.s. nuts in shell for this trade.

The firm reported as follows on the recent Rhodesian samples:—

Spanish Bunch.—The firm are not interested in this variety in shell, even after washing in sand. The size of the nuts is too small, and they consider that the shells would suffer on roasting. The kernels of this type they valued at about £14 per ton, delivered at their works. These kernels would have to compete with Toeban Javan and their skins are darker than those of the Javan supplies.

Masumbika, Virginia Bunch and Jumbo.—The firm considered these kernels as of equal value, but expressed a preference for the Jumbo. The three kinds would have to compete with Chinese h.p.s. kernels. The firm are now buying Chinese h.p.s. kernels at £15 10s. per ton, delivered at their works (equivalent to a c.i.f. price of £14) and Masumbika and Virginia Bunch kernels running 33 to 32 to the ounce would be worth about this figure, whilst the Jumbos, being 28 to the ounce, would command a premium of about £1 per ton. The firm considered that the kernels would blanch satisfactorily.

Most of the kernels this firm buys are either 30/32 to the ounce or 38/40 to the ounce. 26/28's would be worth about £1 more per ton than 30/32's.

The firm would also be interested in any of these three varieties in shell, provided they could be offered with shells as clean and of as light a colour as those of the Spanish Bunch variety after being washed in sand. They consider that the shells would roast satisfactorily and that they could easily dispose of such supplies for the barrow trade.

The firm were most emphatic that the standard of consignments must be maintained, as the sending of produce below standard is most detrimental to the trade. They pointed out that the trade in ground-nuts for edible purposes is increasing and were of the opinion that an additional 500 tons annually of nuts in shell would not have a detrimental effect on the United Kingdom market. Germany also imports considerable quantities of ground-nuts for edible purposes, but the trade is not quite as great as that of the United Kingdom.

(4) A fourth firm, with interests similar to those of the last mentioned firm, stated that they did not anticipate any appreciable increase in the amounts of ground-nuts used for edible purposes, and pointed out that the demand for ground-nuts for the barrow trade is rather limited and for use in confectionery on the decline.

They furnished the following opinions on the Southern Rhodesian samples:—

In Shell.—They did not hold any prospects for Masumbika, Virginia Bunch or Jumbo varieties in shell, even if washed in sand. As regards Spanish Bunch in shell,

unwashed, they thought there might be a small, but limited market in the north of England. They would have to compete with Chinese h.p.s.

Spanish Bunch in shell, washed in sand, should be picked over and all shells containing one or two kernels removed. They thought it might then be possible to find a market for about 500 bags of 80 lb. each. They would have to compete with nuts in shell from Spain and China, but buyers would show a preference for those from Spain over the Rhodesian nuts as the former have a lighter coloured shell.

Spanish Bunch nuts in shell, whether washed or unwashed, will not stand roasting. The shells become reticulated in the roasting.

Kernels.—Spanish Bunch kernels would have to compete with Java kernels, which are quoted at 17s. 6d. per cwt. c.i.f. The skins of the Rhodesian kernels are of the wrong colour and are not as easily removed as in the case of the Javanese.

Virginia Bunch kernels would be suitable for use in confectionery and for mixing with other nuts for dessert purposes. They skin readily. The Rhodesian kernels would probably command a premium of 1s. per cwt. over Chinese h.p.s. kernels, which to-day are worth 13s. 6d. per cwt. c.i.f. The firm considered that kernels of this variety had possibilities.

Jumbo kernels only skin fairly easily and would not fetch as much as Virginia Bunch kernels, though they might be used for the same purposes.

Masumbika kernels are spotty and mixed and would not be readily saleable in the United Kingdom.

The firm did not recommend that large quantities of any of these varieties of Rhodesian ground-nuts should be offered for sale in the United Kingdom. They considered that it would be advisable for the growers in Rhodesia to proceed with caution and export only small quantities at first. Then if the demand should warrant increased exports, larger acreages could be put under these nuts.

Southern Rhodesia Veterinary Report.

MAY, 1933.

AFRICAN COAST FEVER.

Melsetter.—No mortality at any of the existing centres of infection. The infected herd on the farm "Laughing Waters" was slaughtered.

TRYPANOSOMIASIS.

Some mortality in cattle was reported from the Gatooma, Darwin and Sinoia areas. In the Melsetter district this disease was diagnosed on several farms not recently involved. The mortality in cattle during the month was 41 head.

EXPORTATIONS.

To United Kingdom as cold storage beef.—Forequarters, 5,300; hindquarters, 5,581; livers, 12,338 lbs.; hearts, 3,464 lbs., 4,020 lbs.; shanks, 4,228 lbs.

Locust Invasion, 1933.

SOUTHERN RHODESIA.

Monthly Report No. 7, June, 1933.

1. **Locusta migratoria migratorioides.**—No reports of specimens of the European migratory locust have been received during the month.

Eggs laid in confinement and kept under natural conditions have not yet hatched.

2. **Nomadacris septemfasciata.**—Swarms of the Redwing locust are still in evidence in various parts of the Colony. Their movements are not of a definitely migratory character, but there is evidence of a westerly drift due apparently to the prevailing winds.

On the 16th an exceptionally large swarm is reported to have passed over part of the Lomagundi district in a N.-N.W. direction. Apparently this swarm was flying very high, during a portion of the day, but no exact particulars could be secured.

No reports of serious damage to winter crops have been received, and from direct observations the locusts do not seem to be feeding voraciously at present.

Individual fliers of this species have been observed in various localities, apparently left behind by swarms.

The development of red coloration continues generally, although an exceptional individual is occasionally to be met with still retaining much of the coloration of the newly matured individuals. The pink suffusion at the base of the hindwing is now unmistakably developing in many swarms, although still far short of full development.

RUPERT W. JACK,
Chief Entomologist.

Southern Rhodesia Weather Bureau.

JUNE, 1933.

Pressure.—The mean barometric pressure was generally below normal for the month. In the early part of the month a low moved up the east coast and was situated in the Moçambique Channel on the 8th. On the 21st a low appeared to be moving northward, but went off to the east, leaving pressure very weak for some days. All highs approached Southern Rhodesia across the Continent and hence brought little bad weather.

Temperature.—The mean temperatures were everywhere about normal or a little above. No extreme cold was experienced.

Rain.—There was an unusual amount of rain during the month. Thunder conditions prevailed from the 10th to the 12th. Rain fell over the eastern half of the country on the 17th and 18th and many showers were recorded in the north on the evening of the 23rd.

JUNE, 1933.

Station.	Pressure Millibars, 8.30 a.m.		Temperature in Stevenson Screen °F.								Rel. Hum.	Dew Point	Cloud Amt.	Precipitation.			Altitude (Feet)
			Absolute.		Mean.												
	Mean.	Normal.	Max.	Min.	Max.	Min.	½ Max. Min.	Normal.	Dry Bulb.	Wet Bulb.	%	F.	0-10	Ins.	Normal	No. of Days	
Bulawayo	872.7	872.9	78	37	71.3	43.9	57.6	57.3	56.6	48.0	52	40	1.9	.15	.26	2	4,425
Gwelo	866.3	...	78	37	71.0	43.2	57.1	57.1	54.0	48.3	66	43	1.8	Nil	.02	...	4,627
Riverbank...	...	...	85	36	77.4	44.3	60.8	59.3	52.8	45.7	56	38	...	Nil	.02	...	4,090
Essexvale	...	...	88	34	78.6	39.8	59.2	58.2	47.6	43.5	71	39	...	.18	.01	2	3,817
Gwanda	910.8	...	81	33	73.7	42.7	58.2	...	56.5	48.9	57	42	1.6	.06	.06	1	3,228
Nuanetsi	...	...	88	...	77.7	...	...	...	57.3	51.9	69	47	3.2	Nil	.06	...	1,650
Between Rivers ...	...	...	82	35	76.1	41.9	59.0	...	55.2	50.6	73	47	0.9	Nil	Nil	...	3,960
Enkeldoorn	861.3	...	76	35	69.7	45.4	57.6	57.4	56.9	51.0	67	46	2.2	1.17	.03	3	4,800
Gatooma	...	...	81	36	75.7	43.6	59.7	60.0	54.7	49.8	71	45	1.3	.03	.01	2	3,870
Miami	882.4	...	80	41	71.7	47.8	59.8	...	60.4	54.2	67	50	2.9	Nil	.02	...	4,077
Salisbury	858.3	859.3	77	38	70.8	46.0	58.4	57.1	58.0	51.5	64	46	2.3	.19	.01	2	4,885
Sinoia	891.8	...	82	35	75.7	42.0	58.9	...	57.9	51.9	66	47	0.8	Nil	.02	...	3,793
Sipolilo...	888.6	...	79	41	72.4	48.6	60.5	...	62.8	54.9	60	49	1.0	Nil	Nil	...	3,890
Mtoko	881.0	...	81	42	72.1	51.2	61.6	...	60.7	53.9	64	49	1.5	.32	Nil	2	4,190
Inyanga	839.3	...	73	34	66.2	44.9	55.5	...	58.3	49.5	53	41	3.4	.39	.05	4	5,520
Bindura...	895.3	...	82	38	73.7	46.5	60.1	...	57.4	52.2	70	48	2.6	.18	Nil	1	3,800
Graigendoran... ...	...	...	85	39	76.1	45.9	61.0	...	63.4	56.1	63	51	...	.10	.11	3	3,420
Angus Ranch... ...	...	...	84	44	74.6	49.5	62.1	61.6	56.6	52.0	73	48	...	.44	.11	3	2,300
New Year's Gift...	...	...	84	45	74.2	50.5	62.4	...	58.6	54.3	76	51	...	.38	.23	6	2,690
Rusape...	865.6	...	77	35	68.6	43.1	55.8	...	55.1	49.7	68	45	2.0	.68	.14	5	4,630
Riverdene North	...	...	82	30	74.4	37.0	55.7	...	47.6	45.3	84	43	...	.15	.15	4	3,700
Stapleford...	...	...	73	32	61.1	40.9	51.0	...	52.0	...	...	...	4.7	3.10	.64	9	5,290
Umtali...	897.2	898.3	83	43	70.6	50.1	60.3	59.9	59.7	54.8	74	51	3.5	.71	.21	6	3,670
Victoria	899.7	900.5	80	35	71.8	41.6	56.7	55.7	56.7	50.9	67	46	2.1	.05	.07	1	3,570
Melsetter	853.2	...	76	41	68.3	46.8	57.6	...	57.7	50.5	60	44	2.7	.49	.53	5	5,060
Mount Selinda ...	...	...	79	46	67.4	51.1	59.2	...	57.3	53.8	80	51	3.3	.86	.60	6	3,510

Farming Calendar.

AUGUST.

BEE-KEEPING.

This month is one of inaction as far as the apiarist is concerned and the hive inmates are best left alone, except that once a week a corner of the quilt on the top crate may be lifted to see if the wax moth has gained a footing, as it may do in a colony weakened by death from sundry causes, and in which case all such frames should at once be removed. Towards the end of the month, with warmer weather the bees will be tempted out for play spells, cleansing flights, etc., and, according to the season, entrance stops may be opened out slightly with advantage.

In the workshop see that a spare hive or two are in readiness, well painted and ready for use at any hour; also have in readiness any requisite spares, and see that all appliances, such as veil, smoker, fuel, etc., are handy, for swarms may now go and come at a few minutes' notice. Where the bees have been left to their winter quarters with a fair supply of food, good results can confidently be looked forward to for the coming honey flow of the early winter weeks.

CITRUS FRUITS.

The first or spring growth should commence about the middle of the month, and the trees should have a good soaking of water when the new growth commences. If Washington Navel oranges are to set their main crop, frequent irrigations must take place from the time of blossoming up to the rainy season. These irrigations create the necessary humid conditions which are so essential to secure a satisfactory setting of this orange. It is advisable to stimulate the growth of unthrifty trees with an application of one to one and a half pounds of nitrate of soda when the first irrigation is given, this application of fertiliser to be followed by good cultivation. The amount of fertiliser recommended is for mature trees. The packing of late varieties will continue throughout the month. No bearing trees should suffer for want of moisture. Irrigation should not take place immediately before the harvesting of export fruit—at least ten days should elapse between irrigation and the harvesting. This is the best month to cut down citrus trees for re-working to better varieties. As the citrus trees are harvested, all dead, diseased and broken branches and shoots should be carefully cut out before the trees come into new growth.

CROPS.

If not already marketed, the main potato crop will probably be sold about now. Do not forget to grade the potatoes properly according to size. The buyer wants potatoes—table or seed—of even size, not large and small indiscriminately mixed. Select and clean farm-grown seeds ready for next season's planting. Label the bags with name and weight of contents. Build a proper shed for your seed potatoes on the lines recommended in the *Rhodesia Agricultural Journal.* Sort over seed potatoes in store and remove any diseased or rotten. Green oat or barley fodder on wet vleis, or under irrigation, will become ready for cutting. Press on with ploughing and cross-ploughing. Decide what crops are to be grown next season, and,

if you think fit, discuss the matter with officers of the Department of Agriculture. If you have not already effected all your purchases, consider the question of what seed you will require to buy for next season, and discuss the matter with other farmers. If in doubt, consult the Department of Agriculture. In frost-free situations, potatoes can be planted for an early crop under irrigation or on damp land. Cart and spread your farm-yard manure and plough it under as soon as spread to avoid loss. If you have any long stable manure, apply it to your heaviest land. The application of phosphatic fertilisers to the land can continue. If you do not already have one, put up an implement shed, even if it be only poles and grass. Keep wagons and Scotch carts under a similar shed or in the shade of trees. Speed up the making and burning of bricks if this is still in progress.

DAIRYING.

At this time of the year the farmer should experience very little difficulty in producing cream of first-grade quality. As a rule the weather is sufficiently cold to prevent cream, produced under average conditions, from undergoing rapid deterioration, and it is not usually necessary, therefore, to separate a cream of such high butter fat content as is required during the warmer months of the year. During the winter months the separator should be adjusted so as to deliver cream testing 40 to 45 per cent. butter fat.

On exceptionally cold days care should be taken that the milk is not allowed to become too cold before separation—for efficient skimming, the milk should be separated immediately after milking and at a temperature not lower than 90 degrees F.

Farmers engaged in butter-making are usually successful in obtaining a good grain and firm body in butter at this season of the year. Cream can quite easily be cooled to churning temperature if placed outside the dairy and exposed to the atmosphere overnight. During cold weather, however, it is more frequently necessary to warm the cream for churning. The most satisfactory method of warming the cream to the proper churning temperature is to place the bucket or receptacle containing the cream in a tub or bath of water at a temperature of about 95 degrees F., stir the cream frequently and replace the water when cold.

This is usually a critical time of the year for young dairy stock. For dairy heifers, weaned calves, etc., there is possibly no better ration than one consisting of maize silage, legume hay and mixed concentrates, and these feeds, if supplied in liberal quantities, should serve to keep the young stock in a thrifty, growing condition.

DECIDUOUS FRUITS.

All plantings of deciduous trees should be completed by now, as the late planting of these trees is generally unsatisfactory. Pruning may be continued up to the middle of the month. It is advisable to water or irrigate all deciduous trees before blossoming; if possible, a second irrigation should be given after the trees have set their fruit. Follow up the irrigations with good cultivation.

ENTOMOLOGICAL.

Potato.—Early planted crops of potatoes may be attacked by caterpillers. The crops should be sprayed immediately with arsenical wash such as lead arsenate powder, 1¼ lbs. to 40 gallons of water.

Cabbage Family.—Young plants of this family should be kept sprayed with an arsenical wash to check attack by web-worms. The formula given for potatoes with the addition of ½ to 1 lb. of spreader to every hundred gallons of spray should be effective. If cabbage louse is also present add tobacco extract, 1 part to 80 parts spray. Do not spray plants of which the foliage is to be eaten within three weeks.

Citrus Trees.—May be sprayed or fumigated against scale insects, having regard, however, to presence of fruit and blossom. Spraying and fumigating for scale should not be carried out whilst trees are in blossom. Clear young growth of aphis previous to blossoming, using nicotine tobacco wash or Derris.

Guava.—Collect and destroy remnants of late crops to keep down citrus codling, especially if trees are in vicinity of citrus orchards.

FLOWER GARDEN.

Complete digging or forking over the soil as early as possible. Divide and replant dahlias, delphiniums, Shasta daisies, etc. Plant bulbs—tuberose, arum lilies and gladioli. Sow seeds of hardy annuals. Mulch newly-planted roses, shrubs, etc.

VEGETABLE GARDEN.

Plant out asparagus, cabbage,, cauliflowers, onions and early potatoes. Sow seeds of tomato and other plants that are susceptible to frost in a sheltered position; also seeds of various vegetables and salads for summer use.

FORESTRY.

Cuttings of ornamental shrubs, roses. etc., struck in sand last month should be transplanted into good soil as soon as they show a good healthy growth of leaves. A large percentage of cuttings will damp off if left in sand longer than about six weeks. No manure should be added to the potting soil. Seed beds should be prepared and gum seeds sown if required for planting early in the season. If the trees are to be grown in seed beds only and not in tins, then gum seeds should not be sown until October, or later, as they will get too large.

GENERAL.

Fire guards should be completed and every precaution taken to guard against loss of grazing from fires. Natives commence ploughing their softer land this month, and for this reason, as well as because beer is plentiful at the kraals, local labour is apt to be scarce. At this time of the year, however, the need for boys on farms is not so severely felt as later on.

POULTRY.

By the end of this month all those who are not able to give much attention to the chicks while in the growing stage should have stopped hatching. Those who can give some extra care, can continue hatching for another month, but not later, for chicks hatched after August are usually slow in growth and weedy. They do not lay till some months after they should, and eggs are few in number; in fact, they are generally unprofitable.

Now that the hot weather is approaching, a constant war on insects must be carried out, and of these sand fleas and fowl ticks (erroneously called tampans) will be found to be the most troublesome. A bulletin on fowl ticks can be obtained upon application to the Poultry Expert, Department of Agriculture. Sand fleas, as most poultry keepers know. are found on the face, wattles, ear-lobes and combs of the birds. Application of carbolised vaseline will usually kill them at once, or two or three applications of any ordinary grease on successive days are efficacious. More than this is, however, necessary, for the breeding quarters of these insects (and they multiply very rapidly) are in the dust on the floor of the house and that of the run.

The best preventive is a hard floor (preferably of concrete) with no cracks. If this is not possible, the floor and around the house should be treated every week in one of the following ways:—(1) Thorough soaking with a solution of one teacupful of Kerol, Jeyes, Hycol, Izal, or similar disinfectant to a paraffin tin of water, or (2) with a strong solution of salt and water, or (3) dusting over and raking into the soil a mixture of one part flowers of sulphur and two parts finely powdered lime.

Ducks.—See that the breeding ducks have plenty of water, and if possible also some to swim in. Keep young ducklings out of the hot sun, otherwise there will be many deaths. The same applies to geese and goslings.

Turkeys.—Young turkeys must be protected from cold at night, for this is fatal to them. Give them as much free range as possible. and do not allow them to run round the house or on the same ground as fowls do. Turkeys like clean ground; any that is tainted is very detrimental to them. Let them find most of their food in the bush.

STOCK.

Cattle.—On the early granite and sand veld probably the worst of winter is over so far as grazing is concerned, and a nice bite of green grass is appearing. Care should be taken where cattle are allowed to graze on the early burnt grass not to let them get too much at first. On red soil farms the haystack will still be required, and in all cases a certain amount of hay or ensilage should be held in reserve against the possibility of very late rains. In dairy herds on any soils whatever, feeding, housing and bedding should not be relaxed. A satisfactory ration for a medium producing cow in full milk is 5 lbs. of maize, 30 to 40 lbs. of ensilage or pumpkin and 8 to 10 lbs. of hay. If it is possible to give, in addition to the above daily ration, 2 lbs. of ground nuts, crushed with the shell, or oil cake, a very great benefit will be derived. Full particulars of the rationing of dairy cows can be obtained on application to the Department of Agriculture. Calves, especially young ones, must be carefully watched; they should not run too far, and are better inside, except when the weather is warm. They should be fed a little sweet hay, bean meal, linseed, ground nuts or ground nut cake and a small ration of green food.

Sheep.—Sheep should give little trouble at this time of the year. In many places now they will be grazing on the early "burns." The ewes and lambs should be given the best grazing available.

TOBACCO.

The seed bed site should be cleared and well ploughed, preparatory to burning and sowing. The usual date of sowing the first beds is the 15th September. Bulletins covering every phase of tobacco culture can be had upon application to the Editor.

VETERINARY.

Redwater and gall-sickness occur all the year round, although these diseases are more prevalent during the summer months. A good many deaths occur this month, however, amongst imported stock. Vegetable poisoning will probably be in evidence. Sheep can be inoculated against blue tongue. Scab is a poverty winter disease.

WEATHER.

No rain is to be expected, and even on our eastern mountains the precipitation is trifling. Showers, however, do occasionally fall in places, but are of no consequence. The sun is often warm during the day, but the nights are apt to be cold, and grazing being scarce, food and shelter are necessary for the stock.

SEPTEMBER.

BEE-KEEPING.

This is an important month for the bee-keeper, as it starts the first flow of the season. All hives that were sent into winter quarters on a double brood chamber, or otherwise with ample food for that period, should now be overflowing with young in all stages and with a population large enough to take full advantage of the flow. All hives should be carefully examined now and again, entrances opened out to suit the advancing warmth of the weather, and where necessary ventilator lids replaced on the top crates under the hive lid. See that no worry is caused to the bees by ants getting up, and that ample stores of good water (with a pinch of salt and a dash of vinegar) are available for drinking purposes, of which bees consume quite a lot. Swarms can now be looked for; if not required, they can best be destroyed by carbon bisulphide or calcium cynaide—both requiring very careful handling. If it is wanted to increase the apiary, as soon as the scouts are seen looking round for a home, get the decoy hive ready filled with dummy and proper frames of full foundation sheets, or, better still, if they are available, old drawn out brood combs, and as soon as it is taken possession of, insert if possible a frame or two of unsealed brood. As a rule the swarm will settle down at once. Such a colony is best placed in the apiary the same evening, if it can be so arranged. Do not make the mistake so often seen of supplying the new colony with starter frames only; give them full foundation sheets; it pays every time, and more especially so in the first early honey flow. Be sure also and protect the apiary against that persistent robber, the honey bear or ratel, by fencing it with fowl netting and pegging that down with wooden pegs every two feet. The two-footed robber can be just as effectively dealt with by placing a small light chain round the entire hive fastened with small staples and a padlock.

CITRUS FRUITS.

The fate of the citrus fruit crop is dependent upon the treatment the trees receive during this month. If the trees have been given the treatment recommended in the August calendar, and this treatment is followed by good irrigations and cultivation, a good crop of fruit may be expected, whereas a total failure will be the result if the trees suffer for want of moisture at this season of the year.

If not already done, all top worked trees should be headed back early in the month. This cutting back will induce the dormant buds (set in autumn) to commence growth. As the new shoots develop the old tops may be further shortened back until the old top is displaced with a new but profitable one.

The packing of late varieties must be speeded up and completed, if possible, by the end of the month, as the late picked fruit is likely to deteriorate in quality or come into competition with Mediterranean fruits.

All adventitious shoots (water shoots and suckers) must be cut off as they appear, and this work should be continued throughout the growing season.

CROPS.

Utilise your labour to the fullest extent for stumping and clearing more land for mixed crops and for general farm development. Do not be satisfied unless each year sees more profit-earning development work effected. Good organisation of the farm work will permit of much being done without great cost. Begin marking out holes for hand check-row planting of maize, and apply manure or fertiliser. Fertilisers which are to be broadcasted and ploughed or harrowed in can be applied. Do not forget that lands which have been green manured in March or April will require a second ploughing about this date or before being seeded to crops. Early varieties of winter cereals ripen this month and require harvesting. Danger from frost should be past now, and crops susceptible to frost, such as potatoes, onions in beds for the summer crop and Jerusalem artichokes, may be planted where lands are moist. Pumpkins and early maize may be planted on vlei lands. Edible canna may be planted "dry" during the latter half of this month, where some rains may be expected during next month. Overhaul all implements and replace worn parts. Putting this off till the planting season may mean serious loss of planting opportunities between rains. Get out the planters and seed drills. Overhaul and place them in proper working order. Ploughing and cross-ploughing should be hurried on with; also the ploughing under of farmyard manure. A spiked roller can usefully be employed for breaking down clods, particularly on those lands which are to be planted first. Make every effort to secure as good a seed-bed as possible; good seed-beds mean good stands, and good stands are all-important in securing good yields.

DAIRYING.

This is generally the quietest month of the year from a dairying standpoint. Most farmers have by this time exhausted their supplies of winter feed and the production of dairy products is consequently at its minimum. Town milk supplies are now falling off, and a greater use of purchased concentrates in the form of ground nut cake and bran is advisable to keep up the milk supply. Very little cheese is made during this month and stocks are naturally low. Old cheese should be cleared out of the storeroom before the advent of hot weather, and if possible should be sent to be stored under cold storage conditions. Considerable difficulty is to be expected in making butter during this month, as the early spring grass is shooting in the vleis and the butter is consequently very soft. To counteract this, greater use should be made of cotton seed cake, of which a small supply is expected to be available this season.

DECIDUOUS FRUITS.

Newly planted trees must not be permitted to become too dry; watering by hand or gravitation must be continued until the rains commence. Ten gallons of water every fourteen days is sufficient for young trees; these applications should be followed by the loosening of the soil to prevent undue evaporation of the added moisture.

All undesirable growths on the stem and in the centre of the trees should be suppressed as they appear; this will enable the retained shoots to develop normally.

Early fruits must be thinned out this month; only retain two or three fruits on each bearing twig or shoot. Those that are left will then develop into large and attractive fruits.

ENTOMOLOGICAL.

Cotton.—Prevention for most of the boll-worms will be the proper preparation of the ground, with thorough cultivation and eradication of all weeds on the land, particularly those of the family Hibiscus. Wild host plants for stainers should be sought out and destroyed.

Tobacco.—Young plants in seed-beds may suffer from cutworms. Frequent cultivation and laying down of poisoned bait—50 lbs. bran and 21 lbs. Paris green; bring to consistency of a stiff dough, adding water when necessary. Distribute this over the seed-beds in the forenoon, as the cutworm does most of its feeding at night. The beds should be thoroughly burnt over with wood or dry tobacco stalks to ensure that the seed-beds are free from cutworms, and baiting for any coming in from the surrounding ground should then be resorted to when the plants appear. Clear the ground for some distance round the beds, say 30 yards in all directions, and bait this ground thoroughly before sowing—this clearance allows a wide margin over which the cutworms would have to travel. Cutworms' moths are nocturnal in habit, so that the coverings of the beds need to be moth-proof at night; this should be seen to each evening.

Potato.—Early potatoes are liable to suffer from caterpillars. The crop should be sprayed at first sign of injury with an arsenical wash.

Cabbage.—During this month the most prominent enemies of plants of this family are diamond-back moth and web-worm. Cabbage louse is sometimes troublesome. The young plants may be sprayed or dusted with an arsenical compound for the former, and sprayed with tobacco wash and soap for the latter.

Beans.—Planted under irrigation during September usually escape serious infestation with stem maggot.

Citrus.—Throughout the month lime-sulphur spray (1·100) may be used to control yellow citrus thrip whilst on every young fruit. A useful spray against black aphis and thrip is the following:—Nictone, 9 ozs.; Capex spreader, 7 ozs.; water, 100 gallons; Capex lime-sulphur, 1 gallon. This may be sprayed or fumigated against scale insects, having regard, however, to presence of fruit and blossom. Spraying and fumigating for scale should not be carried out whilst trees are in blossom. Clear young growth of aphis previous to blossoming, using nicotine, tobacco wash or Derris.

FLOWER GARDEN.

Cultivate extensively to prevent evaporation and to keep weeds in check. Water plants newly set out, especially such as have their roots near the surface. Thin and regulate growing shoots on roses and various shrubs. Plant out cannas and chrysanthemums (for massing and border decorations) and other herbaceous plants.

VEGETABLE GARDEN.

Sow French beans, leek, spinach, cucumber, egg plant, celery, rhubarb, melons and tomatoes. Small sowings of peas, turnips, beet, lettuce, radish, carrot, parsnip and cabbage may be made now.

FORESTRY.

All cuttings struck in sand in July and not yet transplanted into good soil should have this done as soon as possible. Preliminary sowings of eucalypt seeds should now be made on a small scale, so that transplants will be ready in case the first half of the rainy season should prove favourable; otherwise, bulk sowings should be postponed to October-November.

GENERAL.

Indigenuous labour is apt to become more scarce at this time of the year, the boys returning to their kraals to break up the land for next season. Stock are liable to stray in search of the young grass now coming up, and much trouble from this cause is to be looked for on unfenced farms. Natives are now cultivating their gardens preparatory to sowing their crops, which they do much earlier than do Europeans. The mischief caused by veld burning becomes apparent from this time onwards in the condition of the stock, and it is necessary frequently to move them away in search of grazing.

POULTRY.

The supply of green food to the birds must be kept up; in fact, during the hot weather they require more.

During our dry season the available supply of such green foods as lettuce, cabbages, sunflower leaves is much reduced, but there are many others that can be used, such as belhambra, plumbago, wild cockscomb, plantain leaves, paw-paw leaves, etc. Sprouted oats, barley and wheat should also be used. Many of the young cockerels should now be fit for killing. Keep the best and get rid of the remainder. It is very advisable to caponise all young cockerels when about 2½ lbs. weight. The "Rhodesia Agricultural Journal" of October, 1924, and Bulletin No. 517 give clear and concise details as to the method of performing the operation. Some of the earliest hatched young pullets will show signs of commencing to lay now. No light breed bird should lay until it is 5 to 5½ months old, or a heavy breed until it is 6 to 6½ months old. Should any show signs of commencing to lay before this, they should be moved from run to run to prevent their doing so. A bird that lays before it is fully matured will stop growing, will always be small, and its eggs will for its first year of laying also be small.

When the pullets are four months old, i.e., those of the light breeds, they should be put into their permanent laying quarters, and those of the heavy breeds when they are five months old. A bird that is moved after it has started to lay will stop and very probably go into a moult.

See that young ducklings get plenty of shade during the hot weather. Those destined for killing should not be allowed free range or even a medium-sized run, but should be kept fairly crowded in small runs. It is necessary to get the flesh on them as quickly as possible, and the more rest and less exercise they have, the more rapid will be the growth, and also more succulent and tender the flesh.

The hatching of turkeys should proceed rapidly and be carried on until the end of the dry season. See that they have plenty of chopped onions or onion tops or eschalots, and thick separated milk. These are absolutely necessary if the turkey breeder wishes to be successful with his rearing. Do not give wet food; dry mash such as given to chickens is the better.

STOCK.

Cattle.—Ranching cattle should require little now in a normal season; it is only in the event of very late rains that trouble should be expected. Where possible, it will be wise to keep an eye on those cows that may be expected to calve early, with a view to feeding them if necessary and seeing that they do not get too poor. The supplementary feeding of ranch stock is always a difficult problem. But a small provision of cotton seed, good veld hay, kaffir corn or sunflower silage at this time may be the means of saving many head of cattle when the rains are late. This is a critical month for young stock. Weaning should be completed as soon as conditions permit. The dairyman will carry on much as in August; he will, however, use his discretion (in accordance with the condition of his veld) as to the use of ensilage, pumpkins or other bulky and succulent food. He will be wise not to shorten the supply of concentrated foods for some time to come. A little hay or ensilage should still be kept in reserve until the rains have fallen in reasonable abundance. The object should be to build up the condition of the cows expected to calve when the rains come.

Sheep.—The remarks for August apply. Feed up and shear the rams ready for mating for winter lambs.

TOBACCO.

Hasten the preparation of seed-beds for flue cured type of tobacco. The first batch of beds should be seeded about mid-September; subsequent seeding of the remaining seed-beds should be done (in batches) at fortnightly intervals. The last lot of beds normally is sown by the end of October. Seed-beds for dark fire cured type of tobacco should be prepared for seeding which commences after the first week in October.

VETERINARY.

There should be very few deaths from redwater and gallsickness this month. Cases of vegetable poisoning of stock picking up tempting young green shoots of dangerous character on the burnt veld are of frequent occurrence. Sheep can be inoculated against blue tongue, but ewes in lamb should not be treated, on account of the danger of abortion. Scab may be prevalent.

WEATHER.

The temperature may be expected to rise steadily during this month. Rains are not due until next month, though the average over a period of years shows slightly more than in the previous four months, and ranges between .1 and .5 inch. Frost has been known to occur in September, although this is a very unusual event. Rain-gauges should be seen to before the rains commence. They should be carefully adjusted to stand exactly level with the lip four feet above ground, and care should be taken that no tree, building or other obstruction interferes with the fair precipitation of rain into the orifice.

Price List of Forest-tree Transplants, Ornamental Trees and Shrubs, Hedge Plants. Creepers and Seeds.

OBTAINABLE AT THE GOVERNMENT FOREST NURSERY, SALISBURY.

1. Transplants of forest trees, etc., as far as in stock, are obtainable at the subjoined rates.

2. Orders should be addressed to the Chief, Division of Forestry, Salisbury; or Manager, Forest Nursery, Salisbury.

3. **All orders must be accompanied by a remittance in cash, bank note, postal order, draft or cheque, made payable to the Department of Agriculture, Salisbury. Under no circumstances will plants or seeds be sent out or taken away from the Nurseries unless paid for.**

4. All transplants are despatched at Rate 10 on railways at purchaser's risk. The transplants are watered as far as this is possible by the railway staff.

5. All prices quoted are for delivery free at any station or siding in Southern Rhodesia.

6. Purchasers of trees contained in tins either of 25 or 4 trees are requested to return the tins, carriage forward, to the nursery from which they were obtained, or to the Manager, Forest Nursery, Salisbury. If the tins are not returned within two months from date of issue, they will be charged for at the current rate of petrol tins; present price 4d. each.

7. No trees will be reserved unless specially booked. Orders will be executed in order of receipt as trees are ready for despatch. Every effort will be made to comply with instructions of purchasers.

8. Transplants of forest trees, when quoted at per 1,000, are grown in half paraffin or petrol tins containing 20 to 25

transplants. The average weight of each tin is about 25 lbs. Height of transplants, about 3 to 12 inches.

9. Transplants of larger size, from 1 ft. to 3 ft., are also supplied four in a tin at per tree. Weight of tin, about 25 lbs.

10. Shrubs and ornamental plants in single tins have a weight of about 5 lbs.

11. To purchasers of forest trees, the following reductions are made:—

(*a*) When the number exceeds 1,000, the price is £3 5s. per 1,000.

(*b*) When the number exceeds 5,000, the price is £2 14s. per 1,000.

(*c*) Special quotation for orders over 20,000.

12. Orders for seed are posted or railed free of charge.

13. Though every care is taken to supply trees and seeds true to name and of good quality, no guarantee can be given in this respect, more particularly in regard to seed.

14. Intending tree planters are invited to apply to the Chief, Division of Forestry, Salisbury, for advice as to the most suitable trees for growing in the various climates and soils of the Colony, and on the best methods to adopt in the formation of plantations, wind breaks and shelter belts.

15. No responsibility taken after trees, shrubs, etc., have been accepted by the Railways. Any claim for loss or death should be made to the Railway Company.

Price of Transplants.—For convenience, the following symbols are used to indicate the purchase prices of transplants:—

A—Trees, 25 in tin, at 2s. 3d. per tin, £3 5s. per 1,000; £2 14s. per 1,000 for orders over 5,000.

B—Trees and shrubs, 24 in tin, at 3d. each.

C—Trees and shrubs, 4 in tin, at 4d. each.

D—Trees and shrubs, 4 in tin, at 9d. each.

E—Trees and shrubs at 9d. each; extra large up to 5s. each.

Botanical Name.	Common Name.	Remarks.	Price of transplants.	Price of seed. Lb.	Price of seed. Oz.
Callitris calcarata ...	Black cypress pine ...	Usually rather slow growing, but reaches a fair size and produces a valuable durable softwood. Suited for dry country planting, especially in sandy soil. Resistant to white ants. Good shelter for orchards, etc.	A. C.	15s.	1s.
Callitris glauca	White cypress pine ...	Similar to Callitris calcarata. Better for poor acid soils and ironstone kopjes.	A. C.	15s.	1s.
Casuarina Cunninghamiana	Beefwood	A fine large shade tree, suitable for avenues and narrow belts, but not recommended for timber plantations. Requires deep soil in drier localities. The foliage is useful for stock fodder, and the tree stands lopping well.	A. C.	...	2s. pkt. 1s.
Cedrela odorata		A rapid-growing tree similar to Cedrela toona, but with lighter foliage. Likely to do well on heavy soils, fairly free from frost. 30 to 40 feet in height.	A.		
Cedrela toona	Toona tree	A rapid-growing, handsome, semi-deciduous tree, suited for moister localities where frost is slight. Yields a valuable soft timber. Recommended for plantations, as well as shade and ornament.	A. C.	15s.	1s.
Cupressus arizonica ...	Arizona cypress	A hardy evergreen tree, suitable for dry localities, but requiring a well-drained and rather deep soil. Useful for shelter belts and also for hedges when closely planted.	A. C.	15s.	1s.
Cupressus lusitanica ...	Portuguese cypress ...	A fast-growing cypress, producing an excellent softwood timber, but requires a moist, cool climate and a good soil. May well be used for shelter and hedges in favourable localities.	A. C.	5s.	6d.
Cupressus sempervirens, var. horizontalis	Common spreading cypress	A hardy cypress, suited for limestone as well as other soils. Not so frost or drought hardy as Cupressus arizonica. Suitable for shelter and hedges.	A. C.	15s.	1s.

Botanical Name.	Common Name.	Remarks.	Price of trans-plants	Price of seed. Lb.	Oz.
Cupressus sempervirens, var. pyramidalis	Common upright cypress	An ornamental tree for gardens and cemeteries. Also useful as a shelter tree. Grows under similar conditions to the "var. horizontalis."	A. C.	15s.	1s.
Cupressus torulosa ...	Himalayan cypress ...	A good tree for timber and shelter. Withstands much cold and drought. Not very soil exacting. Fairly frost-hardy.	A. C.	10s.	9d.
Eucalyptus botryoides	Bangalay	A large-leaved, heavy-foliaged gum. Quick growing. Suitable for granite and red soils. Withstands frosts, but not very drought-resistant.	A.	15s.	1s.
Eucalyptus citriodora.	Lemon-scented gum ...	A clean-boled tree, producing an excellent timber. Leaves lemon-scented. Suited for wetter regions and on the better soils in the lower rainfall regions. Will not withstand much frost or drought. Flowers prolifically, rendering it very useful for honey production.	A.	15s.	1s.
Eucalyptus crebra ...	Narrow - leaved iron-bark	A slow-growing, deep-rooting species, producing excel- timber. Suitable for well-drained soils in the higher rainfall areas. Withstands a certain amount of drought and light frosts. Will not thrive in an acid soil.	A.	15s.	1s.
Eucalyptus globulus ...	Tasmanian blue gum	A fast-growing tree, suitable for cool, moist areas with deep soils. Will not withstand drought, but is frost-resistant to a large extent. Produces a useful timber.	A.	15s.	1s.
Eucalyptus maculata .	Spotted gum	One of the best trees for timber production or shelter in the wetter areas, being fairly hardy to drought but not to frost. Produces an excellent timber.	A.	15s.	1s.

Eucalyptus maideni ...	Maiden's gum	A very fast-growing, large tree, with bluish foliage in youth. Fairly drought and frost resistant. Will grow on poor soils if deep and well-drained. Produces a good, strong, useful timber.	A.	30s.	2s.
Eucalyptus melliodora	Yellow box	A medium-sized tree, useful for shelter belts. Produces a tough, durable timber. Very resistant to drought and frost. Valuable for honey production, having abundant sweet flowers.	A.	15s.	1s.
Eucalyptus paniculata	Grey ironbark	A very good timber tree, with heavy foliage. Suitable for the moister regions, with a deep, fertile soil. Withstands some drought, but is frost-tender. Yields an excellent, hard, durable wood.	A.	15s.	1s.
Eucalyptus punctata ...	Leather jacket	A tree of fair size, yielding a good, durable timber. Adaptable as regards soil and climate, but will not withstand a dry, cold climate.	A.	15s.	1s.
Eucalyptus robusta ...	Swamp mahogany ...	A quick-growing, shady tree, which requires a moist soil for best results, but will grow under fairly dry conditions, provided frost is not severe. Recommended rather for shelter belts than plantations.	A.	15s.	1s.
Eucalyptus rostrata ...	Red gum	Produces an excellent and durable hardwood. Withstands drought, heat, brak, flooding and a good deal of frost. One of the best species for planting in Southern Rhodesia, except in sour soil and wet mountain regions.	A.	15s.	1s.
Eucalyptus saligna ...	Sydney blue gum	A fast-growing, useful tree, producing a useful medium hardwood. Thrives on deep, fertile soils in the heavier rainfall areas. Tender to frost and drought.	A.	15s.	1s.
Eucalyptus sideroxylon	Red ironbark	A fairly slow-growing species, suitable for dry, rocky, soils in the moister regions. Produces a good, durable hardwood.	A.	15s.	1s.
Eucalyptus tereticornis	Forest red gum	Similar to Eucalyptus rostrata, and can be planted along with it, except in areas liable to flooding and great heat. Perhaps not quite as drought-resistant.	A.	15s.	1s.

Botanical Name.	Common Name.	Remarks.	Price of trans-plants.	Price of seed. Lb.	Price of seed. Oz.
Grevillea robusta	Silky oak	A handsome tree which thrives best in moist, warm localities. Useful for ornament, shade and timber. Frost-tender and not resistant to drought. If the locality is unsuitable, it may grow well for several years and then die out.	A. C.	...	pkt. 1s.
Jacaranda mimosaefolia	Jacaranda	An ornamental tree with feathery foliage and abundant blue flowers, which appear in spring. Best development is attained in the moister regions, but the tree withstands drought to a surprising extent, and may be planted in the drier regions if the soil is reasonably deep and fertile. It is tender to cold and frost, and many need protection in its earlier youth. Semi-deciduous.	A. C.	20s.	1s. 3d. pkt. 1s.
Pinus canariensis	Canary Island Pine ...	Hardy to drought, but not to severe frost. Best suited for planting on higher altitudes and in higher rainfall areas. Slow growth in early youth, then more rapid in later years. A handsome tree with inverted, umbrella-like branches, not spreading. Yields an excellent softwood timber.	A. C.	15s.	1s.
Pinus halepensis	Aleppo pine	A drought-resistant pine which will grow on limestone and shale soils. Not recommended for plantations, but can be used for shelter and ornamental purposes in the drier regions.	A. C.	15s.	1s.
Pinus radiata (insignis)	Remarkable pine	A large tree of very rapid growth, producing a useful softwood. Most at home in the heavier rainfall areas. Does not like sour or poorly-drained soils. Frost-hardy but not drought-resistant, usually failing at an early age in the drier regions.	A. C.	15s.	1s.
Pinus longifolia	Chir pine	A somewhat slow-growing pine, but useful to plant in localities where the climate and soil are doubtful at the higher elevations. For timber and ornamental purposes. Not frost-resistant or very drought-hardy.	A. C.	15s.	1s.

Pinus pinaster	Cluster pine	Yields a useful, strong softwood. Does well on sandy soils and soils without much lime, in the better rainfall areas. Not very drought-resistant.	A. C.	15s.	1s.
Populus alba	White poplar	A rapid-growing poplar. requiring a good, deep soil in close proximity to running water. Propagated by suckers. Deciduous.	Suckers at 9s. per 100		
Populus deltoidea, var. missouriensis	Carolina poplar	A very fast-growing poplar, producing a very good timber for matches, etc. Requires a rich, moist, alluvial soil. Moderately frost-hardy. Does not like stagnant water.	C.		
Salix babylonica	Weeping willow	A useful timber and ornamental tree, requiring a moist, well-drained soil which is occasionally flooded. Not suited for ground in which water is stagnant.	C.		
		Ornamental Trees, Shrubs and Hedge Plants.			
Abelia floribunda	—	A shrub with myrtle-like leaves, evergreen if watered. Pink-white flowers in profusion. Is used for hedges in Natal.	E.		
Aberia caffra	Kei apple	A rough, thorny, impenetrable shrub, making a good hedge. Withstands frost and drought well. Suited for all but the driest areas of the Colony. More useful than ornamental. Slow growing.	B. E.		
Acacia Baileyana	Silver wattle	A small ornamental tree with blue foliage and yellow flowers.	E.		
Acalypha marginata ...	—	Margin of leaf crimson: a shrub; will grow to 10 feet in height, or clipped to shape. Very useful to give colour to shrubbery.	E.		
Agapanthus umbelatus	Cape Lily	Blue and white varieties.	E.		
Aleurites fordii...	Tung oil	An important oil-bearing tree from China. 25 to 30 feet in height.	E.		

Botanical Name.	Common Name.	Remarks.	Price of trans-plants	Price of seed. Lb.	Oz.
Aloysia citriodora... ...	Lemon-scented verbena	A small shrub with a strongly lemon-scented foliage. Hardy, vigorous, quick-growing.	E.		
Alstonia scholaris... ...		A white flowered shrub, 6 feet high, similar to Oleander.	E.		
Bauhinia galpini	Pride of de Kaap	A rambling shrub, bearing orange-red flowers. Hardy.	D. E.	...	pkt 1s.
Bauhinia acuminata ...	Bauhinia	A large, indigenous shrub, flowering profusely in early spring. White flowers. Hardy.	D. E.	...	pkt 1s.
Bauhinia purpurea ...	Bauhinia	Similar to the Bauhinia acuminata, but with mauve flowers. Hardy.	D. E.	...	pkt 1s.
Bolsusanthus speciosus	Rhodesian tree wistaria	An indigenous, deciduous tree with blue flowers at the end of long stalks. Ornamental.	E.		
Brugmansia Knightii	Moonflower	A flowering shrub with large, drooping, white flowers. Strong scent (of lily). Fairly frost-hardy.	E.		
Brunfelsia eximia... ...	Yesterday,to-day and to-morrow	Shrub 4 to 6 feet. Flowers change colour from purple to white as they grow older.	1s. each		
Buddleia sp.	Blue buddleia	A medium-sized shrub with sweet-scented blue flowers. Useful as a hedge. Rapid-growing, but frost-tender.	E.		
Buddleia sp.	Yellow buddleia	A rank-growing, yellow-flowering shrub. Useful as a hedge. Rapid-growing. Frost-tender.	E.		
Callistemon speciosus	Bottlebrush	A scarlet-flowering shrub of drooping habit. Makes an excellent hedge if trimmed along the top only.	A.C.E.	...	2s. pkt. 1s.
Carica papaya	Pawpaw	A small tree with a large, dark green foliage, bearing large edible fruits.	E.		
Casimiroa edulis	Mexican Apple...	A large, rapid-growing tree, 30-40 feet in height, evergreen, and bears a delicious fruit. A fine shade tree.	E.		
Cassia capensis...	Cape laburnum...	A rapid-growing shrub, bearing masses of bright yellow flowers.	E.		
Cestrum aurantiacum	Ink berry	A small shrub, bearing orange flowers in profusion.	E.		

Crataegus oxyacantha	Hawthorn	Fruits yellow. Deciduous shrub. The yellow berries hang throughout the winter.	E.	
Crataegus pyracantha	Hawthorn	Berries scarlet. Shrub evergreen if watered throughout the winter.	E.	
Croton sylvaticus	Mount Selinda linden	A large-leaved, deciduous tree from Melsetter.	E.	
Cyphomandra betacea	Tree tomato...	The well-known tree tomato. Will grow anywhere where Paw Paws will thrive.	E.	
Dahlia imperialis	Tree dahlia	A medium-sized shrub, making a handsome show with its single white blooms.	E.	... pkt. 1s.
Dalbergia sissoo	Sissoo	A large deciduous tree from India, producing an excellent timber. Desires a deep, porous, well-drained soil in close proximity to running water. Will not tolerate stiff clay. Frost-hardy, but not very drought-resistant. Rapid-growing.	D.	
Datura arborea...	Tree potato	A large shrubby tree, up to 30 feet in height, with large purple flowers. Very quick grower. Fruit poisonous.	E.	
Deutzia crenata	Bridal wreath	A small deciduous shrub with double white flowers, tinged slightly pink, on long, drooping stalks.	E.	
Duranta plumieri	Tree forget-me-not ...	A medium-sized, deciduous shrub with blue flowers. Useful as a hedge. Very hardy.	E.	
Eugenia braziliensis ...	Brazilian cherry	A small shrub, bearing orange-coloured, edible fruits. A useful hedge plant.	D.	
Euphorbia splendens ...	Christ thorn...	A small thorny shrub with bright scarlet flowers. Suitable for low hedges and borders.	E.	
Freylinia Tropica	Inyanga hedge plant...	A useful hedge shrub. Indigenous.	B.	
Gardenia florida	Katjepeering	A compact, evergreen shrub with dark green, glossy leaves and pure white, sweetly-scented double flowers.	E.	

Botanical Name.	Common Name.	Remarks.	Price of trans-plants 3s. 6d. per doz.	Price of seed. Lb.	Oz.
Gerbera Jamesonii ...	Barberton daisy	Hybrids.			
Hamelia patens...	—	A compact shrub 8 feet to 10 feet in height, flower orange-yellow tubes, a showy shrub.	E.		
Heliotropium peruvianum	Heliotrope	A small shrub with sweet-scented lilac or nearly white flowers. Suitable in flower border.	E.		
Hibiscus rosa-sinensis	Chinese rose	Evergreen shrub with numerous scarlet flowers. Double and single varieties.	E.		
Hibiscus syriacus... ...	Christmas rose	A shrub of which there are single and double varieties with white flowers.	E.		
Holmskioldia sanguinea	Holmskioldia	A fairly hardy shrub, bearing a profusion of brick-red flowers in large bunches. Suitable for hedges.	E.		
Holmskioldia sp	Holmskioldia	A yellow-flowering, handsome shrub similar to Holmskioldia sanguinea.	E.		
Hydrangea japonica .	—	A well-known shrub. The flowers are naturally pink, and are changed to blue by feeding the plants with small quantities of Nitrate of Soda, as they grow.	E.		
Hypericum lanceolatum	St. John's wort	A small, yellow-flowering shrub. Multitudes of flowers.	E.		
Iochroma tubulosa ...	Iochroma	A shrub with dark blue flowers.	E.		
Lagerstroemia indaca ...	Pride of India	A large ornamental shrub, with mauve and pink flowering varieties. Handsome and hardy.	E.		
Ligustrum lucidum ...	Chinese privet	An excellent hedge plant or ornamental shrub. Can be clipped into shape. Liable to die off in patches or lose its lower leaves unless planted in moist soil of fair depth. Propagated from cuttings.	A.		

Melia azedarach	Syringa	A deciduous tree, producing a good light timber. Shallow rooting. Withstands drought well. Has fine lilac flowers and persistent yellow berries. Suitable for better rainfall areas and deep sandy soil, but will grow under severe conditions.	E.	
Morus sp.	Mulberry	A very large fruited variety.	E.	
Moschosma	Rhodesian spirea	A medium-sized, blue-flowering shrub.	E.	
Nerium oleander	Ceylon rose	The Oleander, Salmon-pink also a white variety.	E.	
Parkinsonia aculeata ...	Jerusalem thorn	A light foliaged tree, up to 20 feet high, with little yellow flowers, very beautiful as isolated specimen on a lawn.	E.	
Persea gratissima	Avocada pear	A shrub with an edible fruit.	2s. 6d. each	
Photinia japonica	Loquat	A small evergreen tree with large leaves, bearing yellow edible fruit.	D. E.	
Phytolacca dioica	Belhambra	A rapid-growing, deciduous tree. Useful for ornament. Timber of no value, but seeds valuable as a poultry or cattle food.	A.	... pkt. 1s.
Pittosporum undulatum	Camphor laurel	An Australian evergreen shrub, making an excellent hedge, with shining, green, scented leaves and scented berries.	9s. per 100 Class A	
Plumiera rubra...	Frangipani	A handsome shrub with pinkish red flowers. Rather delicate.	2s 6d. each	
Plumiera occulata... ...	—	Similar to Plumiera Rubra but with white flowers.	2s. 6d. each	
Poinciana regia	Flamboyant	A handsome red flowering, feathery foliaged tree.	D.	
Poinsettia pulcherrima	Poinsettia	A shrub with small yellow flowers surrounded by many large, scarlet, leaf-like bracts. Very showy. Double and single varieties. Also pink variety.	E.	
Poinsettia albida	Poinsettia	As above, but with yellowish white bracts. Double and single varieties.	E.	
Psidium pomiferum ...	Guava	A small, hardy, evergreen tree, bearing edible, yellow fruit.	D. E.	

Botanical Name.	Common Name.	Remarks.	Price of trans-plants	Price of seed. Lb.	Oz.
Punica granatum	Pomegranate	A shrub or small tree, having shining leaves, large scarlet flowers and large red fruit. Makes a useful hedge when well cut regularly.	E.		
Rhus lancea...	Karreeboom...	A small idigenous tree of graceful appearance, yielding a very durable wood. Useful for ornamental purposes. Forms a fine hedge.	A.	10s.	9d.
Russelia juncea	Coral fuchsia	A pretty red-flowered shrubby plant about 6 feet high.	E.		
Spathodea campanulata	African flame tree... ...	A handsome, heavy-foliaged tree, bearing bright red flowers. Suited for the heavier rainfall areas on deep soils.	E.		
Streptosolon Jamesonii	Streptosolon...	A shrub with orange-coloured flowers in dense masses and pale green foliage. Very frost-tender and delicate.	E.		
Strobilanthes sp.	—	A shrubby herbaceous plant covered with intense blue flowers in the Autumn. 3 feet high.	E.		
Tecoma Smithii	Tecoma	An upright, medium-sized shrub with tubular, bright yellow flowers. Forms a useful hedge. Fairly drought-resistant.	A. E.	...	pkt. 1s.
Thevetia neriifolia ...	Thevetia	An evergreen shrub, bearing bell-shaped, yellow flowers. Hardy.	E.		
Thuya orientalis	Thuya	A very hardy conifer that withstands heat, cold and drought, and does not mind heavy soils. Slow-growing. Of small size. Very good for hedges.	A. C.	...	pkt. 1s.

Roses from 1s. to 3s. 6d. each.

Climbers and Creepers.

Botanical Name.	Common Name.	Remarks.	Plants each.
Ampelopsis veitchii ...	Virginia creeper	Too well known to need description.	E.
Antigonon leptopus ...	Coral creeper	A showy climber, bright pink flowers, forms large bulbs underground. Takes two or three years to reach flowering size, after this it makes a wonderful display yearly.	E.
Aristolochia elegans ...	Dutchman's pipe	A rank-growing creeper. Heart-shaped leaves. Purplish crimson flowers, spotted yellow.	E.
Aristolochia tomentosa	Dutchman's pipe	A rapid-growing climber, with crimson purple flowers.	E.
Beaumontia grandiflora	Beaumontia	A large climber with heavy, glossy foliage. Large white, bell-shaped flowers. Blooms profusely. Fairly frost-tender.	1s. 3d.
Bignonia venusta	Golden shower	Vigorous creeper. Rapid-growing. Bears masses of orange flowers all the year round. Very useful and hardy.	1s. 3d.
Bignonia speciosa	Bignonia	A rapid-growing, showy creeper, bearing large mauve flowers. Decumbent.	E.
Bougainvillaea splendens	Bougainvillaea	Vigorous climber. May be also used as a hedge. Bracts magenta. Fairly frost-hardy.	1s. 3d.
Ficus repens...		A valuable climber for walls, etc., used in places where the Virginia creeper is grown, but clings to the surface much better than the latter, rather slow at first.	E.
Hedera helix...	Ivy	A dark evergreen climber. Best in shady, cool climates.	9d.
Jasminum sambac... ...	Jasmine	A vigorous, evergreen shrub climber with large trusses of fragant, white flowers.	1s. 3d.

Bontanical Name.	Common Name.	Remarks.	Plants each.
Jasminum primulinum	Climbing jasmine	A yellow-flowering species similar to Jasminum grandiflorum.	9d.
Lantana salviaefolia ...	—	A fine little creeping shrub with pink flowers, very suitable for rockwork, or edging borders, etc.	E.
Lonicera periclymenum	Honeysuckle (Woodbine)	Hardy climber with sweet-scented flowers, yellow inside, reddish purple outside.	9d.
Lonicera sempervirens	Red honeysuckle	Climber with red flowers. Best kept well pruned or base becomes ugly.	9d.
Mandevilla suaveolens	Mandevilla	Deciduous climber, bearing trumpet-shaped, white, fragrant flowers. Very slender.	9d.
Passiflora edulis	Granadilla	A quick-growing climber, bearing edible fruits. Subject to woolly aphis if overshaded. A good trellis plant.	E.
Passiflora sp.	Fiji granadilla	A large-leaved climber, bearing yellow fruits. Flowering well. A good trellis plant.	E.
Podranea Brycei	Zimbabwe creeper... ...	A rank-growing indigenous creeper with large, pink flowers.	E.
Rosa bracteata...	Macartney rose	Plant with large green foliage and numerous white single flowers. Useful as a hedge plant.	1s.
Solanum Wenlandii ...	Blue potato creeper ...	A rapid-growing creeper with tubular, blue flowers. Not frost-hardy.	E.
Wistaria chinensis... ...		The well-known climber with lavender coloured panicles of flowers. Purple, and blue kinds also in stock.	E.

Palms, Bamboos, etc.

Arundo donax	Spanish reed	A reed growing 20 feet to 25 feet in height and 1 inch thick, and very superior to the indigenous variety.	Offsets 1s. 6d. each
Bambusa fortunei	Fortune's bamboo	A small variety, 6 feet high, with canes about the thickness of a lead pencil, extremely useful for stakes in the garden.	Offsets 2s. 6d. each
Bambusa arundinacea	Whipstick bamboo... ...	About 30 feet.	Offsets 2s. 6d. each
Bambusa sp.	Japanese striped bamboo	A very ornamental variety with golden rods marked and striped with green lines, about 20 feet.	Offsets 2s. 6d. each
Bambusa sp.	Indian variety	Similar in growth to the Bindura, with very useful rods.	Seedlings 9d. each
Chamaerops excelsa ...	Fan palm	Suitable for shrubberies, etc.	—
Cortaderia argentea ...	Pampas grass	With long white plumes about 6 feet in height, must be grown near water or close to a tap.	Seedlings 9d. each Offsets 2s. 6d. each
Cyperus papyrus	Papyrus grass	A very handsome subject for the water garden, or planted near the drip of a tap, it does best when growing in the water.	2s. 6d. each
Oxytenanthera abyssinica	The Bindura bamboo ...	The only variety indigenous to Rhodesia, giving very useful solid rods, very tough.	Seedlings 9d. each
Phoenix reclinata	Date palm	A very hardy palm, indigenous to the Colony.	—
Phormium tenax	New Zealand flax	A useful green foliaged plant, about 4 feet high with sword-like leaves.	E.
Washingtonia robusta	Fan palm	A strong-growing fan palm.	—

Palms 2s. 6d. to 5s. each.

Offsets of Bamboos supplied during January only

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No. 862. Cream Cheese, by F. A. Lammas, Dairy Officer.

Points to be observed in Cream Production.

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A List of Plant Diseases Occurring in Southern Rhodesia, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A., Plant Pathologist. Supplement No. 1.

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No. 897. The Report of the Chief Entomologist for the year ending 31st December, 1932, by Rupert W. Jack, F.E.S., Chief Entomologist.

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The Close of the Hatching Season and After, by H. G. Wheeldon, Poultry Expert.

METEOROLOGICAL.

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No. 877. Clouds and Weather in Southern Rhodesia, by N. P. Sellick, M.C., B.Sc., Meteorologist.

MISCELLANEOUS.

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Editorial.

Contributions and correspondence regarding subjects affecting the farming industry of Southern Rhodesia are invited. All communications regarding these matters and advertisements should be addressed to:—The Editor, Department of Agriculture, Salisbury.

Rhodes Inyanga Estate.—As was indicated by the Hon. the Minister of Mines and Agriculture on several occasions in the House, during the last session of Parliament, the Government has decided to change in certain directions the policy in respect of the Rhodes Inyanga Estate.

Alterations and additions are being made to the Manager's house with the object of rendering the building suitable as a country hotel, and it is hoped that it may be ready for the reception of visitors early in October.

The intention is to develop the estate as a health and pleasure resort for residents in the Colony and visitors from elsewhere. Those who have visited the Inyanga Mountains

will well realise how pleasant a stay can be made in the "Highlands" of Southern Rhodesia, and how different the climatic conditions there are to those prevailing over most of the remainder of the Colony.

Renewed efforts are being made to stock the rivers of the estate with trout, and a nine-hole golf course in close proximity to the hotel has been laid off.

The homestead section, which will include the hotel when completed and its immediate surroundings, together with the main fruit orchards—as a separate section—will be leased to Mr. E. B. Allen, who has been Manager of the Estate for the past seven years, and who as lessee of the hotel should by reason of his intimate knowledge of the district be able to be particularly helpful in guiding visitors to the principal beauty spots of the estate and and also to the more interesting of the ruined forts, "slave pits" and "irrigation furrows" which are so numerous on the property.

It is understood that material improvements are being made to the Umtali-Inyanga-Rusape road which traverses the estate for a considerable distance and passes close to the famous "Pungwe Falls." Other roads and bridle paths within the estate to points of interest and beauty are being opened up.

Forestry in Native Reserves.—Mr. J. S. Wilkins, of Bulawayo, who returned to the Colony last year after obtaining a forestry degree at Edinburgh, has been appointed Forest Officer to the Native Reserves Trust. Accompanied by Mr. A. A. Pardy he is at present visiting Native Reserves and becoming conversant with local conditions.

The object of this appointment is to advise on the preservation and better utilisation of indigenous trees, and the establishment of exotic plantations, particularly in the more denuded Native Reserves.

A New List of Rhodesian Grasses.—In order to take stock of our natural grass-lands and to be able to judge whether the grazing lands on our farms improve or deteriorate in value

under the treatment they receive, it is necessary to have a thorough knowledge of all the species of grasses which are represented here. This involves, for the whole Colony, well over three hundred different grasses. Up to the present the commonest species, possibly twenty in number, have become fairly well known, but the knowledge of such a limited number is not sufficient to assess the value of any grass-land. During the last three years a very comprehensive botanical study of Rhodesian grasses has been completed by Miss S. Stent and Mr. J. M. Rattray in connection with the Empire Marketing Board's Pasture Research Scheme, in which this Department has taken an important share. No less than eighteen species were found which had not been described and named and the identity of a number of others had not been definitely established. The completed work has just been published by the Rhodesia Scientific Association. Reprints may be obtained from the Hon. Secretary of the Association or from this office at one shilling post free.

The Royal Show, Derby, July 4th-8th, 1933.—The High Commissioner for Southern Rhodesia supplies the following notes on Southern Rhodesia's participation at the Royal Show, Derby.

The Royal Show was held in fine weather at Derby, from the 4th to 8th July, 1933.

The stand allotted to us had a display frontage of 48 feet, and was very favourably situated in one of the central avenues of the Show ground.

A special feature was made of over 800 lbs. of different types of leaf tobacco, in addition to numerous brands of tobaccos and cigarettes manufactured wholly or partly from Rhodesian leaf.

The exhibit of our agricultural products included maize, maize on the cob, ground nuts, sunflower-seeds, cotton and oranges, as well as cornflour, manufactured from Rhodesian maize by Messrs. Brown & Polson.

The mineral exhibit included gold ore, asbestos (veins and fibre), chrome ore, mica, copper ore and coal.

Further attractions of our stand were dioramas depicting cattle, the cultivation of tobacco, maize and citrus fruits. All the exhibits attracted considerable interest and attention.

Our stand was visited by numerous people who are personally interested in the Colony. They greatly admired our display and expressed their appreciation of the publicity which is being affected by the High Commissioner's office.

Brochures in connection with our Tobacco Industry, lists of brands of Rhodesian tobaccos and cigarettes, and literature of interest to tourists and settlers, were distributed each day during the Show.

The Royal Show was open to the public from 8 a.m. to 8 p.m. daily.

The number of visitors was 96,340 as compared with 47,578 at the Royal Show at Southampton last year.

The Empire Marketing Board.—It is with regret that we learn that the Empire Marketing Board will be discontinued after the 30th September, 1933.

This Colony particularly has just cause to regret that it has been found necessary to discontinue the E.M.B., which has done such excellent work in the cause of Rhodesian tobacco in particular. Directly we have benefited very largely from grants which have been made from time to time to assist in Empire Schemes of Research.

Pasture Research furnishes one of the best known subjects which has been so assisted, but reference to a recent copy of the E.M.B.'s annual report will indicate what an important part the numerous grants which have been made have contributed to scientific and industrial research throughout the Empire.

According to the latest report of the Imperial Committee on Economic Consultation and Co-operation new arrangements have been made to carry on certain functions previously performed by the Empire Marketing Board. The eight Imperial

Agricultural Bureaux, together with the Imperial Institute of Entomology and the Imperial Mycological Institute, are to be associated by having their finances and administration controlled by a central Executive Council. This will involve a small additional expense.

The report recommends that this additional expenditure, together with the costs of the Imperial Economic Committee, the Periodical Market Intelligent Services, the World Surveys and Commodities Series and the Imperial Shipping Committee should be financed co-operatively by the several Governments of the Empire.

Southern Rhodesia has been assessed with 2 per cent. of the total amount involved, £24,000, *i.e.*, £480 per annum. This is an addition to the grants now made to the Agricultural Bureaux, etc. This Government was therefore asked if it would agree to the proposals and has agreed to contribute on the basis recommended for a period of three years in the first instance as from the 1st October, 1933.

Special Dairy Number of The Veterinary Journal.—The April number of the Veterinary Journal has been published as a special dairy cattle number. It is intended primarily to serve as a guide to veterinarians and dairy inspectors in their duties of placing the dairy industry in Great Britain on a sounder footing, especially with regard to safeguarding public health.

The article by Tutt on sterility in the cow is of particular interest to those engaged in combatting this menace, which is so largely in evidence where more intensive dairying and the use of better stock is practised.

The description of the Walker-Gordon milking system in which an Alfa-Laval milking machine is used in a Rotolactor, or revolving platform on which are fifty stanchions, serves as a fitting constrast to the somewhat primitive methods of dairying described in *Dairying in Ceylon*.

Bounty on Stall-fed Chilled Beef.—In terms of Section 1 (c) of Government Notice No. 398 of 1933 an increased Government bounty of ¼d. per lb. dressed weight became payable on "stall-fed" cattle sold to the Rhodesian Export and Cold

Storage Company, Limited, Bulawayo, and exported overseas as chilled beef, between the 1st September and the 31st December, 1933. The total bounty payable on accepted chillers between those dates will therefore amount to ¾d. per lb. dressed weight of carcasses passed for export overseas.

Sellers of cattle or exporters under the scheme will be required to sign a declaration on forms which will be provided by the buyers to the effect that the animals have received additional feed in the form of roughage (hay and fodder), succulents and concentrates, and at the same time to indicate the approximate amounts of these rations which have been consumed by the animals during the period of additional feeding.

Acceptance of the animals as coming within the definition of "stall-fed" will be subject to the certificate of the Government official responsible for the inspection of chilled meat prior to export.

Disinfection of Tobacco Seed.—The Chemical branch of the Department of Agriculture is prepared to undertake the treatment of tobacco seed on behalf of farmers at a cost of 6d. per ounce. Seed for treatment should be sent to the Chief Chemist and the treatment will be carried out in strict rotation.

Ephestia elutella in Tobacco.—Rhodesian bright tobacco entered the United Kingdom in such large quantities during the years 1927, 1928 and 1929 that the stocks in bond on December 31st, 1929, amounted to more than 17 million pounds. The large stocks in the London Warehouses have been held to account for the suddenness and severity of an attack made by a tobacco pest new to the United Kingdom. This hitherto unsuspected and most unwelcome enemy (its ravages caused losses amounting to nearly £100,000 in twelve months) is the *Ephestia elutella*, or Cacao moth. Brownish-grey in colour and scarcely half an inch across when its wings are extended in flight, the moth was first seen flying about the London warehouses in 1929. In the past it had been regarded as the peculiar pest of cocoa, although it was known to feed on dried fruits, coffee, nuts, pepper and chicory. The

investigation following on the outbreak in London showed that its presence in cured tobacco had been recorded only twice previously, in 1915 in Russia, in 1919 in Bulgaria. Its appearance in England led to an enquiry into the source of infestation and pertinent problems. The results of the investigation undertaken by Mr. H. H. S. Bovingdon, of the Imperial College of Science, has just been published by the Empire Marketing Board as a "REPORT OF THE INFESTATION OF CURED TOBACCO IN LONDON BY THE CACAO MOTH." (H.M. Stationery Office, 1/- net).

The Report not only discusses possible sources of infestation for the 1929 outbreak, but also gives details of survey work carried out in warehouses, both at Home and abroad, of experimental work undertaken to ascertain how far kiln-cured and fire-cured tobacco are affected, of methods for dealing with the moth in warehouses and stores. The enquiry has been made possible by the generosity of the Southern Rhodesian Government, which first shared the cost with the Empire Marketing Board. The Board was subsequently assisted by the Imperial Tobacco Company of Great Britain and Ireland and certain other firms.

BRIGHT LEAF TOBACCO PREFERRED.

Experiments have proved that the moths have an overwhelming preference for bright leaf, kiln-cured tobacco, a preference which helps to explain the outbreak in London. There were then in bond enormous stocks of Rhodesian bright tobacco, which had accumulated largely as a result of the Imperial Preference Tariff. This, brought into force ten years earlier, had gradually increased until it exceeded the value of the leaf itself, thus stimulating the growth of tobacco, so that by 1928 imports into the United Kingdom were greater than could be dealt with in manufacture or re-export.

It has not been possible to prove conclusively the source of infestation, but everything points to the outbreak having been occasioned by the presence of insects in tobacco from abroad.

The potential sources of *Ephestia* are many. Apart from Southern Rhodesia, Nyasaland and South Africa, the pest has spread over Eastern Europe, and in 1930 appeared in America.

DIFFICULTIES OF TRANSPORT.

The problem of preventing the tobacco from being attacked in transit seems insoluble as long as the bales are damaged. If they could be transported intact much would be achieved, since bales wrapped in tarred brown paper, covered with a fine-meshed hessian (the moth cannot lay its eggs through a mesh 1/100″ wide) have proved to be immune from attack when untorn.

METHOD OF CONTROL.

It has been found that the reconditioning of tobacco by a modern machine will destroy all stages in the life of the moth. Control can also be exercised by vacuum fumigation with ethylene oxide, or by the application of low temperatures, but much remains to be done to complete the study of the life history and habits of *Ephestia elutella* in tobacco warehouses. There must be closer co-operation yet between entomologists, merchants and manufacturers to make an effective control.

NOTICE.

NOTICE is hereby given that the hunting and shooting of game on Crown lands is strictly forbidden without the permission in writing of the Minister of Mines and Agriculture, and that any person found trespassing on such lands in pursuit of game is liable to prosecution.

GEO. MITCHELL,
Minister of Mines and Agriculture.

The Ninth Maize Grading and Export Conference.

The ninth Maize Grading and Export Conference was held this year on the 17th July in the offices of the Department of Agriculture and was attended by the following:—Messrs. Jacklin (Chairman, Maize Control Board), H. Garmany and J. Bruce (Maize Control Board), J. Buckmaster and D. Black (Farmers' Co-operative Society), the late Admiral Aylmer and G. Sanderson (Maize Association), W. Rogers (Dreyfus & Co.), G. L. Robertson (District Superintendent of Transportation, Rhodesia Railways), A. Hutchinson (Chief Grader of Grain, Companhia de Mocambique), together with H. G. Mundy, the Secretary for Agriculture; Dr. C. K. Brain, the Director of Agriculture; D. E. McLouglin, Agriculturist (Chairman); and L. C. Roberts, Grain Inspector.

The Secretary for Agriculture conveyed the apologies of the Hon. the Minister of Mines and Agriculture for his inability to be present at the opening of the Conference and on behalf of the Government welcomed the delegates. He expressed the Government's appreciation of the courtesy of the Companhia de Mocambique in Government in permitting the attendance of Mr. Hutchinson, Beira, whose visit he considered would provide a very valuable contact with those directly concerned in the export of grain from this Colony, and added that any suggestions and assistance that Mr. Hutchinson could give exporters would be very welcome. Amongst other matters dealt with the following of general interest to farmers may be recorded.

Maize Grading.—The Conference was assured of an adequate grading to cope with the season's exports. Mr. Robertson urged the importance of a steady monthly export which would avoid congestion at destinations in the Union where the situation provided for delivery on certain fixed days of the week and a small number of depots on South African Railways.

Transport of Graders.—The importance of motor transport for graders and their equipment was recognised as an auxiliary to the train service to expedite the grading of small parcels and dry maize, particularly in the early part of the season, when a restricted train service obtained on the branch lines. The Conference was informed that adequate arrangements for motor transport had been made by the Department.

Experiments to Control Moisture and Weevil in Maize Stacked in Sheds.—This item, introduced by Dr. Brain, was discussed with considerable interest. It was represented by the Control Board last year that much damage was done, particularly by soil moisture, to the bottom layer of bags resting on brick floors, and that musty maize represented a greater financial loss than very weevily maize. Dr. Brain reported that the Department of Agriculture had instituted certain investigations last year under his direction and that in respect to protection from soil moisture it had been found that railway sleepers and gum poles spaced correctly provided good protection. Sheets of flat galvanised iron had also been tested, but details of its merits are not fully known owing to all the sheds not having been emptied as yet. In respect to damage by weevil and white ants, Dr. Brain said it had been found that copper sulphate was of no use in controlling weevil, but that it was an effective agent against fungus pests and as a repellent for termites, and recommended the addition of lime. A preparation consisting of 2 lbs. copper sulphate, 2 lbs. of quick-lime and 50 gallons of water had proved effective against white ants in garden lawns. He further advised the use of copper sulphate in preference to arsenite of soda for maize stored in sheds, as the latter was a source of danger to human food. The experiments are being continued and it is hoped that more conclusive results will be obtained in the next year to permit of definite recommendations being made.

The late Admiral Aylmer informed the Congress that he had successfully carried out a test with waste motor oil against white ants and that he had found it very effective in the destruction of colonies. The method adopted was the one advocated in Kenya Colony, as follows:—A narrow trench is made leading into the top portion of the nest and supplies of

water are run down it into the nest until saturation point is reached. The oil is then poured into a full channel of water and is carried down with the water into the nest, where it effectively destroys the whole colony. It was decided to include the experiment in the tests undertaken by the Department of Agriculture. With regard to the fumigation of bagged maize in sheds, Dr. Brain considered that paradichlorobenzene might be tried as it is used extensively in France by farmers against tuber moth in potatoes. Its value would be for protecting the bottom layer of bags from weevils if they are stacked on poles or sleepers, the chemical being scattered beneath the bags.

Moisture Content of Maize.—Mr. Buckmaster enquired whether maize would be accepted from farmers with a moisture content slightly in excess of 12½ per cent. Mr. Jacklin replied that the maize for export was sold on the Government export standard and its certificate, and that a moisture content higher than 12½ per cent. could not reasonably be accepted. Mr. Buckmaster was of the opinion that farmers supplying dry maize in the early part of the season should receive a bonus on such maize. The suggestion was welcomed by the delegates of the Farmers' Co-operative Society and the Maize Association, but it was agreed by the majority that the idea at present was impracticable. It was further emphasised that bagged maize, which had to be stored in sheds, was often required to remain in bulk stacks for a period up to 10 to 12 months and that it was the opinion of the Department of Agriculture that the moisture content of the maize should not exceed 13 per cent. to ensure freedom from heating and mustiness, and greater restriction of damage by weevil.

Quality of Rhodesian Maize.—Mr. Hutchinson, Beira, spoke very enthusiastically on the quality of Southern Rhodesia maize, and stated that he had recently returned from a visit to England, where he had seen some of the Colony's maize. Its condition on arrival there was excellent, and it was some of the best, if not the best, white flat maize sold in England. He considered it unreasonable that Rhodesian growers could not obtain a greater premium in price over much of the other

white maize sold to-day. He reiterated that the quality of Rhodesian maize is well acknowledged by overseas buyers. Quality, he said, was a great factor in expediting the handling of maize at Beira; the high quality of our product greatly facilitated export.

The cutting of bags when loading "bulk" shipments of maize had received the attention of his Government, and he was glad to report a great improvement in respect to the condition of sacks returned to Rhodesia. It often happened that more than one ship took in maize simultaneously, and that the necessity for rapid loading made it almost impossible to ensure that only the stitches should be severed, but every care was exercised in the cutting of the sacks. Mr. Hutchinson contributed to many of the discussions and was warmly thanked for his remarks and suggestions. The meeting closed with a vote of thanks to the Chairman.

Display on the Smithfield Market of Rhodesian Chilled Beef by Messrs. Kean & Co.

The Handling, Preparation and Chilling of Cattle for Export.

By C. A. Murray, Lecturer in Animal Husbandry, Rhodes Matopo Estate, and Government Inspector of Meat for Export, Bulawayo.

Since the beginning of April regular weekly consignments of chilled beef have been exported to the United Kingdom and the trade has opened up a promising channel for the disposal of good quality cattle.

The handling, preparation and chilling of cattle for export require care and skill on the part of the exporter and the farmer. It is the duty of the farmer to breed the correct type of animal, to mature it as early as economically possible, and to deliver it at the chilling works in good condition and free from bruises. From then onwards the exporter must slaughter the animals, prepare and chill the meat and deliver it in the best condition possible on the overseas market.

PRODUCTION OF SUITABLE CHILLERS.

The type of steer required for the export trade was described in the May, 1933, Journal of the Department of Agriculture. Briefly, it is a well bred steer, 3 to 4½ years old, of good beef conformation, *i.e.*, short, deep, broad and compact, weighing approximately 600 lbs. dead weight, and in prime condition. Such steers may be produced as "grass-feds" or as "stall-feds." The question of fattening steers for export was discussed in detail in the May, 1933, Journal of the Department of Agriculture, but a few remarks on the production of prime "grass-feds" suitable for chilling are not out of place.

Up to the present the best grass-fed steers have invariably been produced off well paddocked farms with good grazing and an ample supply of water in each paddock, thus necessitating a minimum amount of walking. *There is little doubt*

that small paddocks, good grazing, ample clean water and a minimum amount of walking are very important in the production of prime grass-fed steers.

It is generally impossible to produce suitable chillers off the veld when the animals run in 2,000 to 10,000 acre paddocks and have to walk several miles each day to water and often much further for dipping. In such cases most of the nutrients derived from the grass are used up to supply the energy required for walkinig instead of being used for the deposition of fat. *It is recommended, therefore, that at least one or two small paddocks 300 to 800 acres in extent with good grazing and ample water be available for the export steers during the season they are intended to be marketed.* Under such conditions the animals will have every opportunity for laying on fat.

A.—HANDLING OF CATTLE ON FARM.

Bruises.—Cattle intended for export should arrive at the chilling works free from bruises. This is very important. Bruises spoil the appearance of the carcasses and so lower the selling value of the meat and ultimately the price paid to the farmer. Very often the outer protective connective tissue covering of the meat and the meat itself are broken and blood stained to such an extent that decomposition sets in very soon. Such bruised quarters cannot, therefore, be exported and are sold on the local market at a loss to both the exporter and the farmer. Some bruises, depending on their nature, take up to 8 weeks to heal, and it is therefore necessary that every possible precaution should be taken by the farmer to prevent the animals from being bruised while running on the farm or on the way to the chilling works. In this connection the following points are of importance :—

1. **Dehorning.**—The many advantages of this practice cannot be over emphasised. With dehorned animals horn bruises, which are often very serious, and horn damaged hides are eliminated altogether. In addition to this polled animals are more docile, easier to handle and better feeders.

2. **Dipping, Kraaling, etc.**—During these operations great care should be taken to prevent bruising, especially over the shoulders and hips. At dipping the cattle should not be forced and crowded into the entrance race of the dip. Crowding into the draining pen or draining race should also be prevented as there the shoulders and hips often come into violent contact with uprights or gate posts. Natives should under no circumstances be allowed to carry sticks or whips and use these on the cattle.

B.—TRANSPORT TO THE WORKS.

1. **Trucking.**—Before trucking is commenced the pen and race at the station should be examined and any places likely to cause bruises should be padded with bags of grass. Here, too, the cattle should not be excited and allowed to get crowded into the race or door of the truck. They should be handled very quietly, and gently coaxed to enter the truck. With a little patience and the assistance of an electric prodder this is quite easy. Sticks or whips should never be used.

The trucks specially padded by the Rhodesian Railways are excellent for the conveyance of export cattle to the chilling works. It has been found that practically no bruising takes place in the trucks provided they are loaded to capacity. When only a few animals are put in they are pitched about, bumped against the sides of the truck and badly bruised. Depending on their size, it is advisable to load 10 to 12 steers per short truck.

2. **Trekking Cattle by Road.**—It is usually necessary to drive cattle a certain distance to the railhead or direct to the chilling works. Such driving should be properly organised. The length of the different stages will depend on the grazing and watering facilities, but wherever possible they should be driven in short, easy stages during the night or cool part of the day. It may even be advisable to rest cattle for a day or more at the railhead before trucking if they have been driven over a very long distance and are fatigued.

C.—AT THE WORKS.

Handling Prior to Slaughter.—On arrival at the chilling works the cattle are off loaded carefully and grazed and rested until 24 hours prior to slaughter when they are brought into the pens and given nothing but clean drinking water until killed. This assists in slaughtering and ensures better bleeding of the carcasses. Cattle should never be slaughtered immediately after having been driven some distance or when overheated and excited, as the colour, bloom and keeping qualities of the meat are invariably affected.

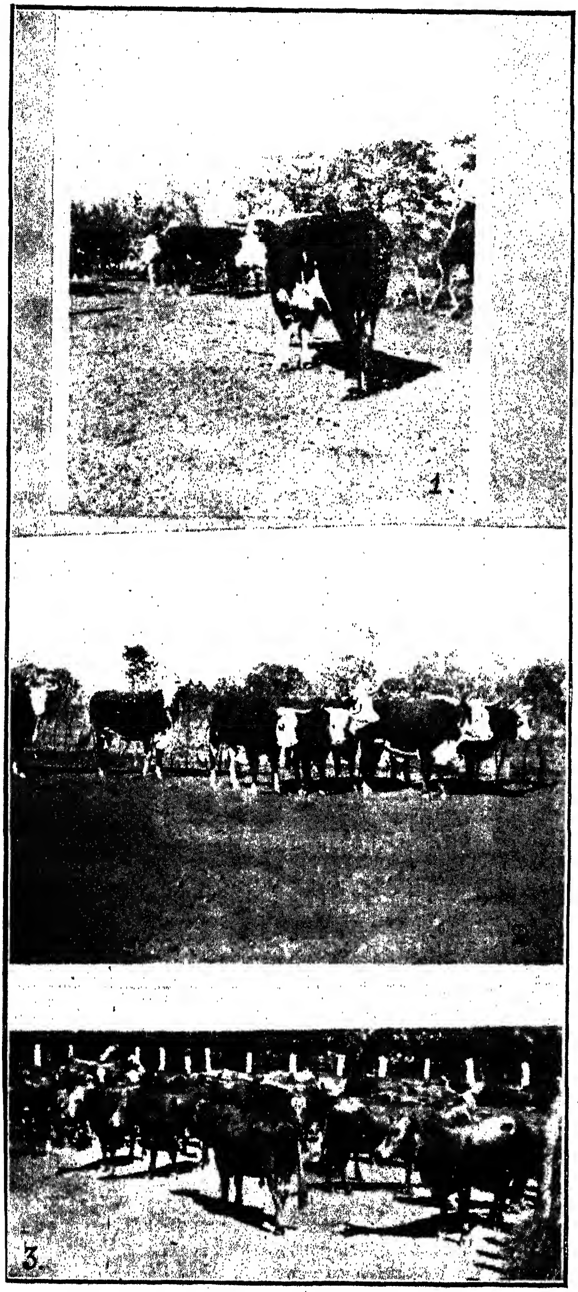
Killing.—From the resting pens the animals are taken in fives, or whatever number of killing beds are in use, thoroughly cooled under a water spray and driven along a padded race to the stunning box. As each animal enters the stunning box it is poll-axed with a quick, snappy blow. It is struck just above the place where the lines from the base of each horn to the opposite eye would cross. It is of interest to note that stunning with a poll-axe is a very much more desirable method of killing than pithing, as with the latter method the pumping action of the heart stops practically immediately with the result that bleeding is not so complete as with the former method.

Hoisting.—Immediately the animal has been stunned it is tipped out of the stunning box on to the floor, a chain shackled round both hind shanks and the animals hoisted until the head is well off the floor.

Bleeding.—Immediately after hoisting the arteries and veins of the neck are cut at the point where they branch to the shoulders and neck. When bleeding is practically complete the fore legs are pumped up and down several times to assist in getting more of the blood out of the forequarters.

Skinning and Disembowelling.—The skinning of animals for the chilled beef trade requires great skill, as on no account should the meat be lacerated, the fat left on the hides or the carcasses spoiled.

After thorough bleeding the carcass is lowered and propped flat on its back on a support called a pritch. While in this position skinning is commenced down the sides of the



nd 2.—Well bred, 4-year-old, grass fed chillers in prime condition
IG. 3.—The dehorning of steers is strongly recommended.

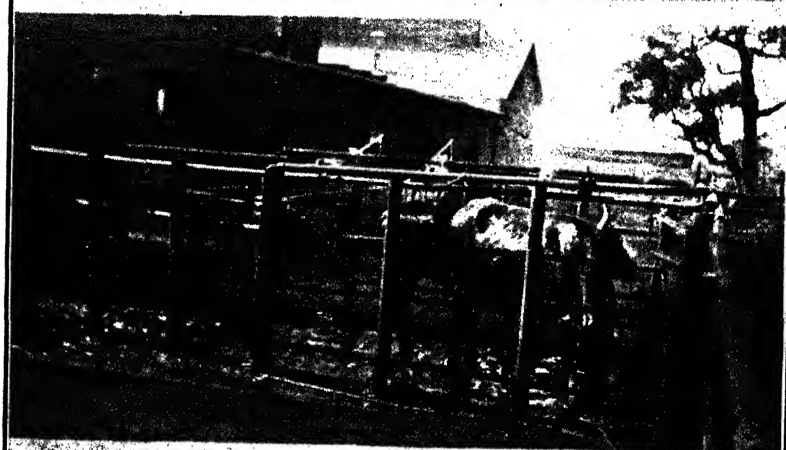


FIG. 4.—Chillers resting in a 2-acre Paddock after arrival at the Chilling Works.

FIG. 5.—Steers being cooled under a water spray.

FIG. 6.—Lightfoot-stone Refrigerator Truck of the Rhodesia Railways.

belly, the breastbone, flanks and inside and outside of the legs and the front and hind legs cut off at the knees and hocks respectively. At the same time the abdominal cavity is opened and the caul fat removed. Next, with a sharp saw the breastbone is split through to the neck. Following this the aitchbone is split. This should be done very carefully with a sharp knife, special care being taken to expose the white connective tissue on both hindquarters.

When this stage has been reached the carcass is hoisted to a convenient height so that it can be skinned round the tail and over the rump and buttocks.

The carcass is now also disembowelled, special care being taken not to cut the stomachs or intestines and thus soil the meat.

As skinning proceeds down the back and sides the carcass is hoisted more and more to make the work easier. This procedure is followed until ultimately the hide is removed from the shoulders and neck.

During the above operations every possible precaution should be taken to prevent the carcasses from being soiled. The floors should be continually cleansed with big rubber squeegees and swilled with clean water. The carcasses, too, while skinning takes place, should be carefully wiped with well-rinsed, wet, hot cloths. Water for washing the carcasses should be used as little as possible, as it spoils the bloom and removes some of the thin layers of fatty tissue over the legs and insides of the ribs.

After the carcasses have been skinned, disembowelled and wiped clean over the inside and outside they are carefully split down the backbone with a large, electrically operated circular saw. After splitting the spinal cord is removed and the backbone scrubbed free of bone and meat-dust. The two sides are now passed over the weighing machine and weighed separately. From now on until they are put into the pre-cooler the sides are further cleaned and dressed, the neck veins cut out and the kidney veins opened, cleaned and plugged with with pieces of absorbent cloth to absorb the blood and fluid continually dripping out. After all this preliminary cleaning and dressing the sides are ready to go into the pre-cooler for cooling and further cleaning, trimming and dressing.

Pre-Cooling.—Before the sides are put into the chilling room it is necessary to hang them in a pre-cooling chamber at approximately atmospheric temperature *i.e.*, approximately 60° F., until the "animal or body heat" has been lost. This usually takes from one to two hours. While in the pre-cooler the carcasses are also further cleaned and trimmed before they are finally put into the chilling rooms.

Inspection.—Before the sides are put into the chilling room each quarter is carefully examined by the Government Inspector, and any old, unfinished, coarse, staggy or badly bruised quarters rejected for export.

Chilling.—The meat should remain in the chilling room for at least 72 hours. When the sides are put in the temperature of the room should be about 45° F and when filling is completed it will usually have gone up to about 50° F.

During the chilling period the control and correct adjustment of the temperature in the room require great skill and experience as the bloom, outside appearance and quality of the final product depend very largely on the success of these operations. The temperature is brought down slowly and carefully more or less according to the following schedule:—

Period of Chilling.	Temperature of Chilling Room.
Before sides put in	45° F.
Filling of room completed...	50° F.
After 3 hours chilling	45° F.
,, 6 ,, ,, ...	42° F.
,, 9 ,, ,, ...	40° F.
,, 12 ,, ,, ...	38° F.
,, 15 ,, ,, ...	36° F.
,, 18 ,, ,, ...	34° F.
,, 21 ,, ,, ...	33° F.
,, 24 ,, ,, ...	32° F.
,, 27 ,, ,, ...	32° F.
,, 30 ,, ,, ...	31° F.
,, 33 ,, ,, ...	30° F.
,, 36 ,, ,, ...	30° F.
,, 48 ,, ,, ...	29° F.
,, 60 ,, ,, ...	29° F.
Until loading into trucks commences...	29° F.

After chilling for approximately 60 hours the sides are quartered between the 10th and 11th ribs and each quarter neatly double-wrapped in white stockinette. During wrapping each quarter is also weighed and the weight stencilled on the stockinette. The quarters are then left in the chilling room until chilling is completed and they are then ready to be loaded into the trucks.

Trucking.—Up to the present the overhead-bunker ice-refrigerator trucks of the South African Railways have been used for the conveyance of Southern Rhodesian chilled beef to Cape Town, and have proved very successful. Experiments are also being carried out with the Lightfoot-Stone Mechanical Refrigerator trucks belonging to the Rhodesian Railways which are expected to be in full use shortly.

When loading commences the quarters are transferred from the chilling rooms into the trucks with as little delay as possible. During loading it is necessary to hang the quarters according to a definite system to prevent excessive chafing and staining. A very successful system of stowage in the trucks has now been evolved as a result of which the meat arrives in Cape Town in a clean, unchafed condition. On arrival at Cape Town the quarters are off-loaded and quickly transferred into the cool chambers of the boat and are then ready to be shipped to the Smithfield market.

Notes on African Aloes.

By H. Basil Christian, Ewanrigg, Arcturus.

PART XII.

Aloe globuligemma.—*A. globuligemma* was first collected in M'Phathlele's Location, near Pietersburg, Northern Transvaal, and was described by Dr. Pole Evans in Trans. R. Soc. S.A., vol. V. It occurs in Southern Rhodesia in the Sabi Valley, on the Umtali-Chipinga road, along a stretch of 4-5 miles near the turn off to the new bridge, usually in dense patches, single plants being rare. It also occurs in the Plumtree District, at the opposite end of the country. It is a distinctive aloe. The unopened flowers are a rich nopal red (R.C.S.) tinged with green at the tips. When open, the flowers become a sulphur yellow (R.C.S.). The filaments which extrude considerably are chestnut brown to black. It flowers in July and August and throws out suckers from its base.

Description.—A succulent stemless plant. Leaves 16-23 in a dense rosette, glaucous, erect-spreading, 45-50 cm. long, 8-9 cm. broad at the base, lanceolate-ensiform, acuminate, acute and recurved at the apex, unspotted, somewhat flat at the base and canaliculate above with cartilaginous wavy and toothed margins; teeth pale brown and at right angles to the margins, 1.5-2 mm. long and about 8-9 mm. apart, deltoid, recurved. Inflorescence a panicle with 5-7 spreading horizontal to oblique branches with a few small deltoid-acute empty bracts at the base. Peduncle 0.6-1 metre high, stout, glaucous, naked. Racemes densely flowered 22-40 cm. long. Flowers secund, all pointing towards the centre of the

Aloe Ecklonis.

Aloe Greatheadii.

Aloe globuligemma.

inflorescence and at the same time slightly deflexed; young buds distinctly globular; in open flowers nopal red (R.C.S.), green at the tips; mature flowers sulphur-yellow (R.C.S.) and tinged with red towards the base. Floral bracts reflexed, 5-6 mm. long, ovate-cuspidate, scariose, pellucid. Pedicels recurved, 3-4 mm. long. Perianth 25 mm. long, cylindrical, ventricose; outer segments free for 15-17mm., obtuse and recurved at the apex, 3-5 veined; inner segments obtuse, recurved, tipped with auburn (R.C.S.) at the apex, with 3 minor veins. Stamens exserted for 11 mm., filaments slightly recurved, the exposed portion chestnut-brown (R.C.S.) to black. Anthers mars-orange (R.C.S.). Style pale sulphur yellow, stout, recurved. Capsule shortly stipitate, 23 mm. long, 13 mm. dia., oblong-ovoid.

Aloe Greatheadii.—*A. Greatheadii* is widely distributed over Southern Rhodesia in almost every type of soil and country. It also occurs in Bechualand and the Northern Transvaal. It is described in *Flowering Plants of South Africa* as having a stem up to over 6 inches dia. and 1 foot high, but I have neither seen nor heard of a plant with a stem of this size in Southern Rhodesia. It is, with us, an acaulescent or sub-acaulescent spotted leaf aloe, the markings on the upper surface being very conspicuous, the lower surface being pale green more-or-less lined with dark green longitudinal lines. The inflorescence which is branched and up to nearly 6.0 feet high usually has long lax racemes of very pale coloured flowers which are not at all showy, but the flowers are often congested into short dense racemes. It flowers in Southern Rhodesia in June and July. In the dry season the green of the leaves changes to brownish and the leaf tips wither.

Description.—Acoulescent or sub-acoulescent. Leaves densely rosulate, about 47 cm. long, 12 cm. broad low down, and 13 mm. thick, tapering gradually from the base to the apex. the upper surface concave, dark glossy green, with

numerous elongated whitish spots which towards the base are usually confluent and form irregular transverse bands, the lower surface unspotted, pale green more-or-less lined with interrupted dark green longitudinal lines, especially towards the margins; the margins usually with a distinct brown cartilaginous border, marginal prickles brown, pungent, spreading, usually quite straight, about 5 mm. long and up to 20 mm. apart, interspaces straight or curved. Inflorescence branched, up to 1.75 m. high, usually 2 or 3 from the same rosette, Peduncle glaucous, smooth below; branches usually with 2 or 3 long-acuminate, acute, membranous bracts, about 3.2 cm. long and 7 mm. broad at the base; bracts subtending the branches about 18 cm. long and 3 cm. broad at the base, long-acuminate with a few prickles on the margins towards the apex. Raceme somewhat lax up to 30 cm. long, but often with the flowers congested into a short dense raceme about 9 cm. long; floral bracts long-acuminate, acute, many-nerved, about 32 mm. long and 5 mm. broad at the base, lower pedicels 12 mm. long. Flower buds uprights, whitish with 6 broad longitudinal stripes which are greenish above and reddish below, the open flowers pendulous; perianth 32 mm. long, 7 mm. dia. over the ovary, constricted above the ovary to 5 mm. dia., thence ampliated to 8 mm. dia. on the one axis, and laterally compressed to 6 mm. on the other curved, tube a little over half the length of the perianth; the outer segments both inside and outside white with a broad, red, faintly 5-nerved median line; inner segments white, shading to yellow at the apex with a red 5-nerved median line; stamens and style as long as the perianth, or slightly exserted, stamens pale flesh colour, style yellow; ovary 9 mm. long, 3 mm. dia.

Aloe Ecklonis.—*A. Ecklonis* is one of the deciduous aloes of Berger's "Leptoalœ" section and occurs in the grassveld from Grahamstown in the south to the high veld grass land of the Northern Transvaal. It is the commonest of the aloes of

Basutoland, according to Capt. H. Ashton, who has made a study of the flora of that country. It thrives under Southern Rhodesian conditions, flowering in March, and the flowers have the advantage of lasting longer than many of the aloes in this section.

Description.—Stem short. Leaves about 15-20, rosulate, up to 39 cm. long, 24 mm. broad and 6 mm. thick in the centre, tapering gradually from the base to the apex, nearly flat on the upper surface above, but concave lower down, lower surface convex, glaucous green, lineate, more-or-less spotted with small somewhat elongate narrow spots, the lower surface more copiously spotted; marginal teeth small, deltoid whitish, about 5 mm. apart low down with straight interspaces, higher up becoming more and more minute; peduncle stout, simple, about 8 mm. dia. clothed with green lanceolate-deltoid, shortly-cuspidate empty bracts; inflorescence 38 cm. high, capitate, about 3 ins. dia.; floral bracts lanceolate-deltoid, shortly-cuspidate, 3-nerved, about 14 mm. long; pedicels stout, 20 mm. long and 1.5 mm. dia., elliptical in cross-section. Perianth ochraceous-buff (R.C.S.), distinctly stipitate, somewhat 3-angled, 20 mm. long and 8 mm. dia., outer segments connate at the base, faintly many-nerved, contracted at the apex, somewhat shorter than the inner segments, inner segments pale green shading to white at the margins; stamens pale-yellow, 3 included, 3 just exserted; anthers reddish-brown; style whitish, just exserted; ovary 8 mm. long and 3 mm. dia.

Brick-making on the Farm.

By A. C. Jennings, Assoc.Mem.Inst.C.E.

(This article is a re-print and revision of those written by Mr. G. T. Dyke and the same author, and published in this Journal in April, 1921, and August, 1926, respectively.—Ed.)

It should be the aim of every farmer that all buildings erected on his farm, except of course those intended for purely temporary purposes, should be a permanent asset to the property. Many types of construction have been adopted for farm buildings in this country, but there is little question that a well-constructed building of burned bricks is as satisfactory and economical as any that can be erected.

The making of a good brick on the farm becomes, therefore, an important matter, as if it is made of unsatisfactory or badly prepared materials, or improperly burned, it quickly deteriorates when exposed to the weather and the buildings have considerably less value. The work is not one that can be left entirely to native labourers, and constant supervision should be given.

Materials to Use.—A common idea is that bricks must be made of ant-heap. Good bricks can be made of this material, provided the ant-heap is derived from suitable soil, but where a large quantity is required one cannot go to the expense of carting ant-heap, or making bricks wherever the ant-heaps happen to be.

Generally speaking, this country is not rich in deposits of good brick clays and marls such as are found so extensively in the alluvial basins of many countries in Europe. The former of these is composed chiefly of hydrated aluminium silicates, with more or less sand (the true clay substance), undecomposed grains of felspar, and oxide or carbonate of

iron. The marls or lime clays contain also the above substances, and, in addition, a percentage of chalk (carbonate of lime). These marls burn to a sulphur yellow colour, which is quite a distinctive feature in some parts of England.

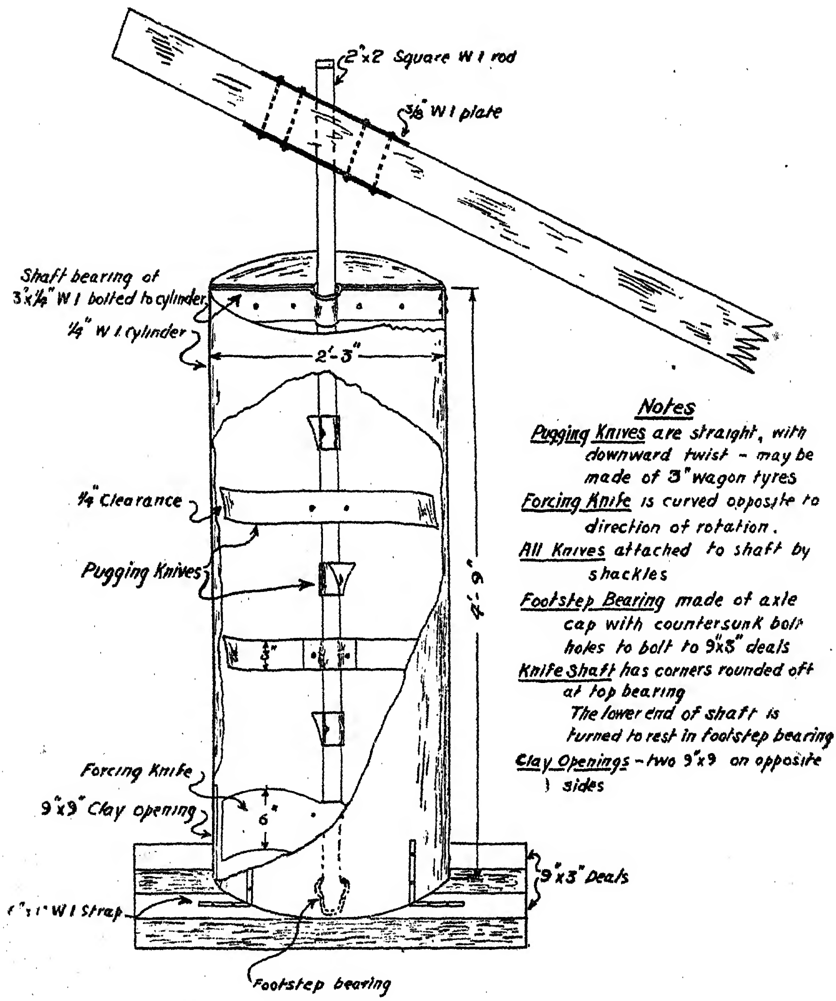
The materials generally available throughout Southern Rhodesia, while not perhaps being ideal brick clays, are usually sufficiently good for making a good rough brick suitable for practically all farm purposes. In the granite areas the clayey material derived from the decomposition of the granite, which is generally found a few feet below the surface, will in most cases be suitable. In the red soil areas, that is where the soils are derived from the various rocks commonly spoken of as the schist formations, the clayey sub-soil can be used, but where this is too rich in clay, as is sometimes the case, it should be mixed with coarse sand in about the proportions of three of clay to one of sand. The granite materials will usually be found to contain sufficient sand without any being added.

The deposits of clay available in other geological formations than those stated can be judged only on their merits, and local knowledge and experience are often obtainable concerning same.

The best material is often found in valley bottoms or along the river banks, and frequently does not require any admixture with sand.

The material to be used can always be tested by making a few trial bricks and allowing them to dry for a day or two in the shade. Those too rich in clay will dry slowly, shrink, and readily crack, and in firing lose their shape; while those too sandy will be friable and distintegrate when handled. A brick made from good material should, when drying, be tough and plastic; a good brick clay has a gritty feel when rubbed between the fingers. All clays are much improved by being "weathered," that is turned over and exposed to the atmosphere some months before being used.

Preparing the Materials.—All materials to be used in the making of bricks must be well mixed and puddled, which can be done either by tramping in pits or passing through a pug mill. Where the clay to be used is very stiff and hard to



PUG MILL

Fig. 1.

work and large quantities of bricks have to be made, the pug mill will save labour, and is in fact essential; but, in many cases, on the farm tramping by natives will suffice.

A small pug mill to be worked by animal power is shown in fig. 1. It consists of an open top iron cylinder provided with a vertical shaft on which are set a number of blades. The clay, which has previously been wetted down in soaking pits, is fed in at the top, and when the vertical shaft is rotated at a slow speed the blades cut and mix the clay, forcing it in a downward direction. It is then squeezed out of an aperture at the side of the cylinder and handled into the moulds.

Where the brick clay is to be puddled by natives, it can be done by excavating a soaking pit in the ground about 12 feet by 6 feet by 2 feet deep. This pit is divided into two compartments by placing a piece of corrugated iron across the centre and forming two pits each 6 feet by 6 feet.

The brick materials, after being excavated, are first turned over and mixed in the dry state on the ground, and then thrown into one pit, water being added as required, and tramped into a pasty, but not too sloppy mass. After well tramping and puddling, the clay will be ready for use and can be taken from one pit while a further quantity is being prepared in the second pit.

Lay-out of Brickyard.—The general lay-out of the brickyard is shown in fig. 2. A good strong deal table about 12 feet by 4 feet and 2 feet 4 inches in height is placed alongside the puddling pits, and the clay is handled from the pits to the tables and then fed to the moulders, two of whom can work at the positions shown in fig 2. In many cases the table is dispensed with and the moulding is done on the ground; the moulder standing in a shallow pit.

The brickyard should be in the vicinity of a piece of level ground, which must be cleared of vegetation, and made level for use as a drying or depositing ground.

Moulding and Depositing.—The moulds, to take three bricks each, are made of well-seasoned flooring boards, cut and screwed together, and strengthened at the ends with

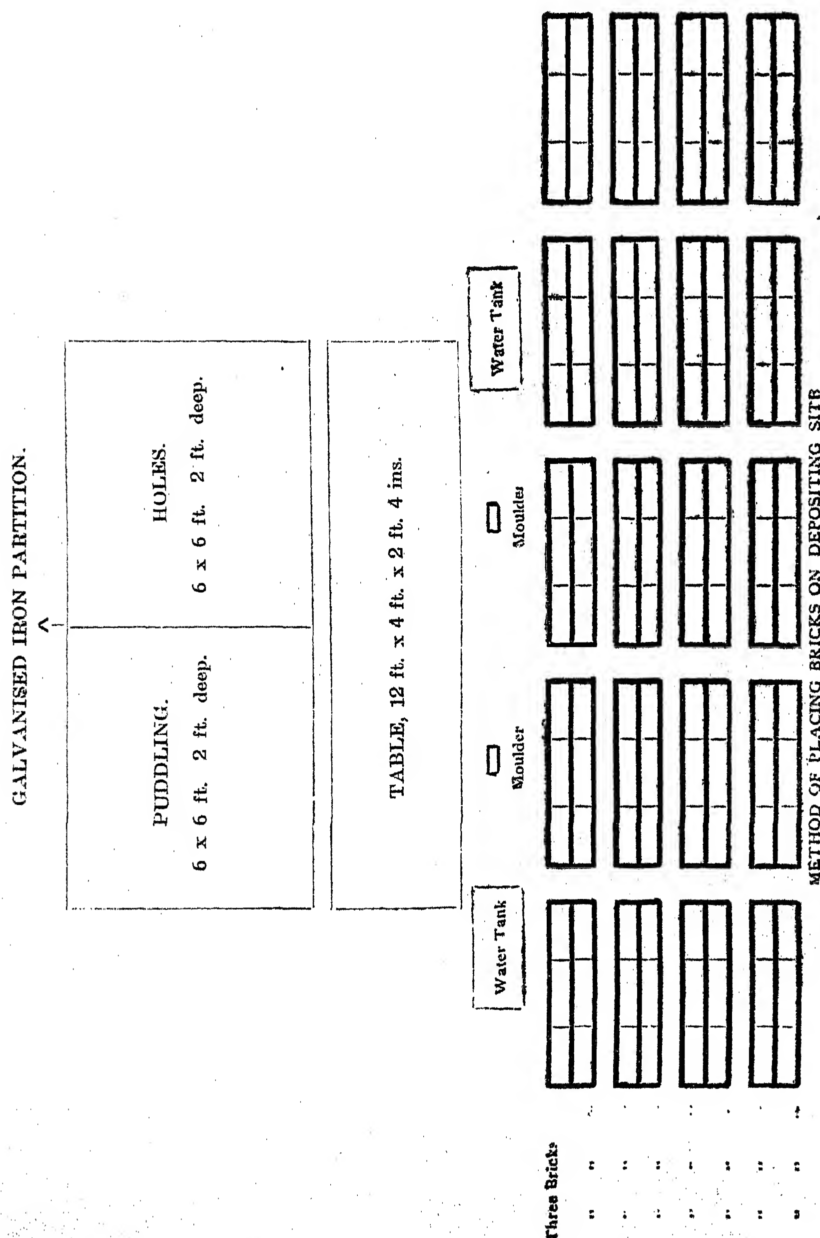

GALVANISED IRON PARTITION.
PUDDLING.
6 x 6 ft. 2 ft. deep.
HOLES.
6 x 6 ft. 2 ft. deep.
TABLE, 12 ft. x 4 ft. x 2 ft. 4 ins.
Water Tank
Moulder
Moulder
Water Tank
Three Bricks
METHOD OF PLACING BRICKS ON DEPOSITING SITE

Fig. 2.

hoop iron. The inside measurement of each mould should be $9\frac{1}{2}$ inches long, $4\frac{5}{8}$ inches wide and $3\frac{1}{8}$ inches deep, which, after allowing for shrinking and drying, gives a finished brick 9 inches by $4\frac{1}{4}$ inches by 3 inches. Good moulds can nowadays be purchased ready-made at a small cost, and this is recommended in preference to using a home-made article, each moulder requiring about three moulds. A galvanised iron tank or hole filled with water is arranged at the side of each moulder, in which are placed the moulds as each carrier returns from the drying ground.

In moulding the bricks, the moulder takes a mould and dusts it with fine sand to prevent the clay from sticking. He then takes a rudely shaped lump of clay and dashes this into the mould, which rests on the bench in front of him. He presses the clay well into the corners with him fingers, scrapes off any surplus clay, and levels the top with a piece of wood called a "strike." The mould is then carried away, and the bricks laid out flat on the drying floor.

If it is required to make bricks with a frog, that is a hollow one one face, the moulds are placed over a stock board provided with an elevated tongue. When very large quantities of bricks are being made it is desirable to use metal in place of wooden moulds.

Drying and Firing.—The bricks, as soon as they are made, are laid out flat and close together in rows on the drying floor and covered with grass. In about two days they can be turned on to their edge, and then in about a further two days can be picked up and stacked on edge in double rows to a height of about 3 feet, leaving spaces for air to pass freely between them. After a further three days the stacks should be turned, and in six days after this should be ready for burning. During the whole time that the bricks are drying they must be protected from the direct rays of the sun by being covered with grass, straw, sacks, or old pieces of corrugated iron. They should similarly be protected from rain, should any happen to fall during the drying period.

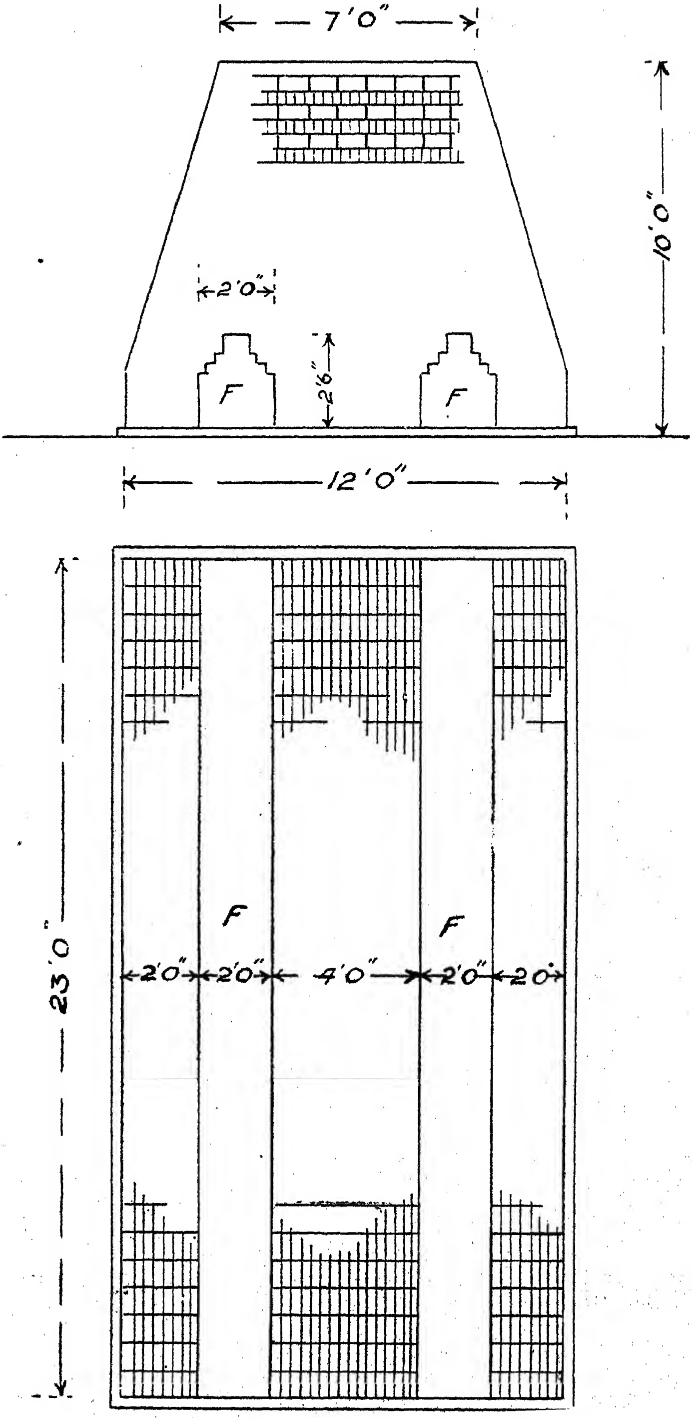
Building the Kiln and Firing.—There are many different types and methods of building kilns—in fact, almost every brickmaker has his own particular views on the subject.

When making bricks on a commercial scale, the kilns are usually very large and built to contain 60,000 or more bricks. In such kilns the bricks are stacked with great care, and layers of cinders or coke placed between every two or three layers of bricks, so that, once the kiln is lighted, combustion takes place throughout the whole kiln, thus ensuring a more uniform output of burned bricks.

On the farm, especially where a settler has had little previous experience in brick-making, the burning should at first be done in smaller kilns holding up to about 25,000, which will be of about the dimension shown in fig. 3. When he becomes more experienced he can, if desired, make larger kilns with six eyes for about 60,000 bricks.

In building the kiln, the bricks are packed about finger space apart, in what is known as five over two setting, that is five headers over two stretchers. The fuel chambers, F. sometimes called "eyes," are carried right through the kiln and the tops are stepped or corbelled in to form a closure. The fuel used should consist of sound dry logs not less than 4 inches diameter, and should be closely packed in place, with dry chips underneath, at the time of building the kiln.

When the kiln is built, the whole of the outside walls should be well covered with dagga to exclude air, or cased with broken bricks from the drying floor and then covered with dagga. The top of the kiln is covered with bricks laid flat and closed as described later. After the fires are ignited the end of the fuel chambers should be closed up with either bricks or iron sheets. The fires will require attention every few hours, a little fuel being added each time, the ends of the fuel chambers being opened for stoking and closed again immediately afterwards. The fires must be kept continuously burning for seven to ten days, the aim being to maintain as uniform a heat as possible, the top of the kiln becoming red hot by the time the burning is completed. Care must be


7'0"
10'0"
2'0"
2'6"
F
F
12'0"
23'0"
F
F
2'0"
2'0"
4'0"
2'0"
2'0"

taken to leave the top of the kiln uncovered after the burning is started for two or three days, in fact until the steam has escaped, and the fire starts showing through the top. It can then be covered with loose earth, or, better still, wet manure.

Considerable practical knowledge and experience are required in the making of good bricks, and new settlers having no knowledge of the subject would, at the commencement, be well advised to employ a contractor to make a certain quantity for them at a fixed price, or engage the services of a good native or coloured man, who will usually undertake to make them at piece work rates per 1,000 bricks. It should be borne in mind that there are about 10 per cent. broken or waste bricks in a kiln, so that the raw bricks made should exceed by this amount the quantity required. Considerable care must be taken in removing the bricks from the kiln, or a larger percentage than that stated will be broken.

Some Notes from the Cotton Station, Gatooma.

By J. E. Peat, B.Sc. (Edin.), A.I.C.T.A. (Trinidad)

Empire Cotton Growing Corporation.

"In this. as in all scientific work, observation and measurement must precede theory."—*Nature*, July 8th, 1933.

The improvement in the level of cotton prices in the last month or two has renewed interest in the growing of cotton in Southern Rhodesia. It is likely that a fair acreage in parts of the country will be planted this coming season, certainly a considerably larger acreage than for the past two years. The following notes from the Cotton Station, Gatooma, summarising more or less some of the information and ideas resulting from the work, will be of interest to growers.

Strains and Substrains.—The original U4 multipied up from the Barberton selection at Gatooma in 1927-28 and first issued to growers for season 1928-29, has now been replaced largely by U4/64 (Gatooma No. 5), a first generation selection from the U4 stock. This was first issued to growers for multiplication and large scale observation in 1930-31. It has done consistently well under a fair range of conditions, and now represents the commercial seed stocks of most of the growers, who have been carrying on during the period of low prices. Without doubt it is the most satisfactory basic strain bred out at Gatooma from the original U4. Some of the most promising material now being worked with on the Station has been bred from it.

It is a hardy, medium-sized strain, not carrying a great deal of leaf, fairly early, and a free fruiter. It has a good power of fruiting recovery after a drought period or bollworm attack. As regards jassid resistance, it is moderately good, although not as good as a number of the other strains; apparently, however, it is sufficiently resistant for ordinary com-

mercial purposes at present. With a ginning percentage of around 33 per cent., it gins out slightly lower than many of the other strains.

Being only a first selection, one generation removed from the parent stock, the original U4, it is, under multiplication, segregating to some extent, and a number of undesirable types are showing up.

There are several strains, now at the observation-multiplication stage, to replace it. U4/64/7/10 (Gatooma No. 5,11), a descendant from U4/64, but three generations removed from the original U4 stock, is breeding fairly true and has been showing very good results. It did very well at Gatooma under multiplication in 1931-32, a season of good growing conditions, and again this season, a season of drought; this past year, under multiplication with a number of growers in Mazoe and Lomagundi, it has done very well. Of the U4/64 type, medium in size, it is early maturing and a free fruiter.

Another selection from U4/64, two generations removed from the bulk U4, is U4/64/V (Gatooma No. 5,21). It was the outstanding strain at the multiplication stage on the Station in 1931-32. This year it has been about 10 days to a fortnight later than U4/64/7/10 (G.5,11), and in this, a short droughty season, while entirely satisfactory, it has not been so striking; the same applies to the observation-multiplication plots in Mazoe and Lomagundi. In a more normal year it produces better quality lint than U4/64/7/10 (G.5,11), and gins out better. It probably developes a better rooting system, producing a heavier, slightly leafier, type of plant, with bigger bolls. It also is a good free fruiter with good powers of fruiting recovery. Some of the selections from it promise to be outstanding.

U4/64/7/10 (G.5,11) is about ten days to a fortnight earlier in cropping than U4/64/V (G.5,21) in a season such as the past, but there is quite a good strain, U4/26/B/2 (G.2.26), which is earlier even than U4/64/7/10 (G.5,11). It is one of the earliest maturing strains bred on the Station. A small-growing strain, with small bolls, it fruits freely under normally good growing conditions, but does not possess much power of fruiting recovery. The lint is moderate; the jassid

resistance is not as good as many of the others. U4/26/B/2 (G.2,26), or some of its derivative substrains, may be important in areas where early maturity is of the first importance.

U4/34/2/1 (G.4,2) is a moderate strain, free growing, with a very high degree of jassid resistance, suffering little even from the heaviest attack induced on the Station. Rather a late strain, it is only a moderate fruiter. Two selections from it, however, U4/34/2/1/2 (G.4,5) and U4/34/2/1/3 (G.4,6), while retaining the parent's high degree of jassid resistance, have distinctly better fruiting powers, and are earlier.

U4/64/1/2 (G.5,24), is another U4/64 strain with distinct possibilities, fruiting heavily, and yet maintaining a fairly good jassid resistance. In another family, U4/78/3/5/2 (G.6,16) and U4/78/3/5/3 (G.6,17), stocky strains, with good-sized bolls and fairly good jassid resistance, are yielding well under moderately good conditions. They probably require rather better conditions for good results than most of the U4/64 derivatives; on the other hand, with good conditions, the bigger bolls and slightly better ginning percentages might make them more satisfactory strains to grow.

These strains and substrains are survivors from several hundreds originally selected, but gradually discarded after careful examination season by season. Further re-selections from these, and from other strains not yet at the multiplication stage, are being carried on, and show improvements on the parent stocks in certain qualities.

Small quantities of seed of the strains and substrains described will be available for growing under observation by a number of growers throughout the country this coming season, and a more limited amount, in seed packets, for observation-multiplication. They each have distinctive qualities which may make them suitable for particular conditions.

Spacing.—Trials and observation throughout the country show that a spacing in the row of somewhere around 6 to 12 inches, leaving two plants to a hill where the spacing gets wider than that, seems to be giving the most satisfactory results. A spacing in the row, closer than about 6 inches, is not to be recommended. A forced early growth may result,

especially if the start of the season is favourable, with a pronounced check later on in any long drought period, or, as in this year, a sharp early finish to the rains. In the better growing areas, and on the richer lands, a slightly wider spacing, 12 to 15 inches in the row, might well be tried, especially if an early and satisfactory start is obtained.

Soils and Fertilising.—In the past it has been suggested to growers that it was not worth while fertilising their cotton directly, but rather to fertilise crops known to respond to direct fertilising, such as maize and tobacco, and to fertilise green manure crops with raw rock phosphate, growing cotton after them. So far, with present methods of application, there has been little evidence of appreciable response on the part of cotton to direct fertilising, though satisfactory results have been obtained when grown after other crops fairly heavily fertilised. There is undoubtedly need for more information on this aspect of the growing of cotton, as it requires at least a reasonably well-grown crop to produce a heavy yield of good quality.

Cotton has been doing moderately well on lands where maize yields have been falling off, probably better than any alternative crop; for that reason there has been a tendency to plant on worn-out maize lands; but for really favourable results and good quality lint, better quality land in good heart is required. Again, in a short droughty season, such as the past, crops on the better soils have pulled through more happily, have grown out better, set a crop and suffered less from natural shedding, induced by the droughty conditions, than have crops on the poorer soils. On the Station, where none of the land is rich, the best results, definitely, have been obtained on the best land and after the ploughing in of humus. Many of the Rhodesian soils suffer from a lack of humus, and the addition of this by green manuring is probably of the first importance, preceding any scheme of fertilising. On richer soils it may pay to take off a crop such as maize, after green manuring, before planting cotton.

As regards really rich soils, experience will show how best they may be managed for cotton. There is a danger in a good growing season of producing an excessively vegetative, late maturing, crop, very liable in wet years to stainer damage.

Insect Pests.—Experiments have been going on in this country in collaboration with Parsons, at Barberton, and more intensively there, in the use of *Trichogramma lutea*, an egg parasite, for the control of bollworm. The results so far obtained have not been satisfactory. But the Rhodesian strain or strains of *Trichogramma lutea* appear to be considerably more virile than the Barberton ones used in the parasite release experiments. Quite high percentages of natural parasitism have been obtained from collections of American bollworm eggs from cotton and maize, from the Station, and from farms in Mazoe and Lomagundi, contrasted with a relatively low natural parasitism around Barberton.

American Bollworm (*Heliothis obsoleta*).—Careful records of the attack of American bollworm have been going on for several years, and attempts made to learn something of attacks in other parts of the country and in crops other than cotton. The American bollworm is an enemy of the buds, squares and young bolls, and a severe attack may do serious damage in a comparatively short time. The attack varies from year to year, from district to district, and even from land to land

It is now more or less clear that American bollworm is attacking cotton, when it does, because there is nothing more attractive *flowering* at the time. The moths apparently are present for most of the growing season—probably in the cold weather the pupal periods are protracted—and there are cycles of attack from crop to crop throughout the growing season.

The egg-laying on any particular crop seems to be definitely at the period of flowering for that crop; in maize just at the time of the extrusion of the tassel, and in maize this attractive period for the plant lasts only about ten days.

In Rhodesia there is in most years a heavy egg-laying on citrus about the end of August, then in the flowering stage. Illustrating the cycle of attack from the Station this past year, there was an egg-laying on stand-over Dolichos beans, flowering in November-December; then an egg-laying on the first planted crop maize in February; on later planted crop maize at the end of February—beginning of March; on cotton early in March; on later developing cotton in mid-March; on

lated planted maize in March; on very late cotton in March to early April; on Dolichos beans, flowering, in the second half of March—through April; and then, at the end of April to May, on young selfsown Dolichos beans, then flowering, which came up after a stand-over Dolichos crop ploughed in, in February.

The important point is that the attraction to the crop for egg-laying takes place always at the time of flowering for the particular crop. Speaking generally, in this country it is when the general bulk maize crop is no longer attractive to the American moth, that is when tasselling is completed, that egg-laying starts heavily on cotton. The time of egg-laying on cotton depends, of course, on the nature of the rains, whether early or otherwise, favourable or patchy. On the Station, year by year since 1928-29, the American egg-laying has started, at the end of February; about mid-February; mid-February; in the first week in February; and then this past season—a season of late planting rains and patchy early growing conditions—in the first week of March.

Similarly, records taken in other districts, Mazoe and Lomagundi, in 1930-31, showed that egg-laying in cotton was taking place after the maize had ceased to be attractive. In 1931-32, an early season, the egg-laying was around the end of January to mid-February; and this past season, when the attacks were small, egg-laying took place towards the end of February.

The main heavy American egg-laying can thus, on the Station, be expected on cotton somewhere around 80 to 90 days after planting, two to three weeks after the flowering has got going. The period after planting, before heavy American egg-laying starts, depends, of course, on the type of planting and growing season and on what checks the plants may have received from drought or excessive rains.

The maize crop is taking somewhere around 60 to 70 days to come to the tasselling stage, varying, of course, from season to season with weather conditions. With fairly good conditions tasselling is fairly uniform.

A very important point is that the plants are only attractive to the American moth for egg-laying for around ten days.

Thus with an ordinary uniform maize crop, a little over a fortnight covers the attractive stage to the moth, and any one planting. With patchy early conditions tasselling is more irregular, and the crop is attractive over a longer period.

These results are in full agreement with Parson's findings at Barberton, where more intensive and detailed experiments and records have been made, than has been possible so far in this country.

It seems likely that good use may be made of this knowledge of the egg-laying of the American bollworm moths, in reducing the attacks on cotton. This coming season, careful experiments will be laid down on the use of maize and other crops, as traps for the egg-laying moths, but it may be useful for growers in their planting this coming season to make some use of the knowledge already obtained. Only experience over a few years will show what success in the way of control may be hoped for.

In ordinary practice, commercial crop maize will be planted over a period of say three weeks to a month from the start of planting, providing at the tasselling stage, say about five to six weeks attraction to the moths. The last portion of the commercial maize might well be planted reasonably near to the cotton lands. Now it is suggested, in addition, that three distinct fair-sized trap plantings of maize, say one to two acres, depending on the size of the cotton land, be made in proximity to the cotton lands, to be used for ensilage, planted at about 14 day intervals—depending, of course, on the weather—the first trap crop planting going in about 14 days after the last of the commercial bulk maize. With big cotton lands, more than one trap-crop block at each planting may be advisable. The maize from these trap-plantings may be cut and used for the making of ensilage after the egg-laying period, that is, after the plants have ceased to be attractive to the egg-laying moths. Possibly varieties of maize, earlier maturing than those normally grown, could be used to preserve continuity of tasselling, if irregular rains interfere with the planting of the ordinary maize trap crops. It may be possible with little trouble and very little expense, to reduce considerably American bollworm attack on cotton by regulating planting of other crops. Only experience will

show the best time for, and distribution, of these trap crop plantings. It may be possible to regulate other crops subsequent to maize, such as beans, somewhere near the cotton lands, attracting the egg-laying of the later moths. This year on the Station, for example, there was heavy American egg-laying on Dolichos beans from the end of March, by which time egg-laying had ceased on the cotton lands nearby.

Sudan or Red Bollworm (*Diparopsis castanea*).—Practically nothing is known about the veld host plants in Rhodesia of this bollworm, although the moths may travel a long way from their host plants; so far as is known, no other crop plants are attacked except cotton. On the Station, Sudan bollworm has been troublesome each year for the past three years, in the second half of February, March, April and May, in a continuous attack on the developing bolls. It is highly probable that the attack each year is a carry-over from the breeding of the previous year. During the cold weather the pupal periods are protracted.

Areas previously badly attacked by Sudan bollworm, where cotton growing has been discontinued for a year, on the resumption of growing, are practically free from Sudan bollworm; but in a number of years, what might be called a stock, gradually breeds up again. It is probable, therefore, that with an increase again in the acreage under cotton in Rhodesia, the first year or two may be fairly free from trouble with Sudan bollworm, but later on it may work up as a fairly serious pest, as on the Station.

The attracting of the egg-laying of the early moths, emerging after the rains, is suggested as a method of partial control. After a heavy attack a block of stand-over cotton, or lightly ratooned cotton, should be left to attract the egg-laying of these moths emerging in November-December.

These trap crops must be watched, and, if heavily attacked, as those on the Station have been, they must be grazed with cattle, thus destroying the eggs laid and the larvæ developing, preventing the new generation of Sudan themselves going down to pupate. This probably will have to be done more than once. Experience will show how best to manage these traps in practice, the best size of block to leave, and how often they may require to be grazed down.

The period from egg-laying to the final bollworm instar, the fully grown bollworm, ready to pupate, is around five weeks. When the new crop is well-going and flowering, the trap crop may be ploughed out.

From work carried out by Parsons, it would appear that more might be done than has been usual in the way of later and more thorough cultivation between the rows, and up to the plants, where the state of the soil and the plant size permits. Normally cultivation ceases when flowering is well-going, about February, or, in a late year, about the beginning of March.

It has been found that later cultivation—a pegtoothed cultivator has given the best results—stirs up the soil, displaces and damages the Sudan pupal cases. Some of the pupæ are destroyed in the cultivation, and others are much more liable, as a result of the breaking of the earthern pupal cases, to be destroyed by ants and other predators. This later cultivation may well assist in the partial control of the serious Sudan attack which has been evident on the Station for the past three years, arising out of the March and April egg-laying.

Stainers (*Dysdercus spp.*).—It is believed now that the main natural food plants for stainers in the veld in Rhodesia are one or more species of *Sterculia*, a veld tree and a relative of cotton, not uncommon in areas throughout the country. They also feed on the seeds in the broken fallen fruits of the Baobab, another relative of cotton. In settled districts, however, these fruits are much sought after by natives for food, and it would be only on the seeds in the broken fruits on the ground that stainers could feed.

Sterculia is found growing generally as scattered individuals or in small groups, on or below the sides of kopjes, and in that sort of broken country. Stainers feed on the fruits and seeds; the fruits, on ripening, spilt open, exposing the seeds in a sort of pod. From Barberton work it appears

probable that the winged adult stainers leave the veld and migrate to cotton only when the food supply, furnished by *Sterculia*, is more or less finished, and thus, that there is a relationship between the fruiting of *Sterculia* and the time of the migration of stainers into the cotton lands.

It is likely, though further recording work is needed to trace out these relationships, that there is a relationship between years of considerable and lighter stainer attack, and between years of late and early arrival of stainer from the veld, and the particular fruiting conditions of *Sterculia* for that year, induced by seasonal factors. Work at Barberton this past year appears to show that around that area the different stainers species are present on *Sterculia* for different periods, and leave at different times, and that one species, the last to leave *Sterculia*, is mainly responsible for the transmission of internal boll disease.

Moderate sized crops offering as they do less shade and moisture, are less attractive to the incoming adults from the veld than are heavily grown, lush, crops. Factors contributing to earliness in the crop, the getting of a fair portion of the crop opened before the main invasion from the veld takes place, will be important in minimising the damages caused by stainer attack; although even here there is a certain complexity in that factors contributing to earliness in the crop are often factors predisposing the crop to jassid damage, and the earliest maturing strains are not the most jassid resistant. With goodish crops it will probably pay if stainer is present, to pick the first picking rather sooner than has been customary, as soon as there is a fair first picking ready. This is probably wise in any event, as the tendering effects of the sun, the dew, and the alternating heat and cold, on the open cotton, very probably have a weakening effect on the character of the staple. Little is known of what actually does happen to the exposed cotton, and it will be useful to carry out some experiment on this next season. Keeping in mind the necessity for

low picking costs and at the same time thinking of the quality of the lint and seed, judgment will be needed as to when to start picking. With stainer present, with earlier picking, there will be a reduction in staining in the first picking and definitely less damage to the seed.

It appears likely in Rhodesia that only in years of late autumnal rains will stainer damage be very heavy. Whether this is related to temperatures, or to moisture and humidity, is not clear. This past year stainer attack has been negligible. Work is still going on in assessing the effectiveness of the system of trapping the early incoming adults from the veld on cotton seed traps, in relation to the stainer population present in the lands at the time.

Report of the Cotton Specialist, Empire Cotton Growing Corporation for the Season 1931-32.

Season.—The season opened well with good early rains which enabled farmers to get their lands into fine tilth. This favoured early planting, and ensured good germination.

The greater part of the season appeared to be favourable to the cotton crop in most districts, but unfortunately the autumn rains were considerably prolonged. It can be safely stated that in most years the rains finish about the middle of April, after which time the weather becomes dry and favourable to the ripening of the cotton crop. The season under review, however, was exceptional and the late rain caused a continuance of humid conditions which favoured an increase in insect pests, particularly jassids and stainers. In addition to the increase in the number of stainers, their effect on the crop appeared to be unduly prolonged. This, no doubt, accounts for the bad opening which was generally experienced throughout the country except for isolated crops, chiefly in the Hartley area. The occurrence of internal boll disease also appeared to be worse than in any former year, and was doubtless due to the same cause.

Harvesting.—The crop was slow in opening, rendering picking operations difficult, and the low prices which were ruling at the time did not act as an incentive to growers to concentrate on this operation.

Seed Supply.—One of the more serious aspects of the season will be reflected in the quality of seed for planting purposes. Owing to so much internal boll disease, it is unlikely that the resulting seed will possess a high germinating capacity. At time of writing it is not possible to state what germination in the field has been like, but it is anticipated that it will be poor. With the heavy seed rate recommended and generally adopted, however, it is hoped that fair stands will be obtainable.

Cotton Breeding Station, Gatooma.—Contrary to the general conditions which prevailed throughout the greater part of the country, the season is considered to have been the best experienced on the Cotton Breeding Station at Gatooma since it was first organised seven years ago.

Jassid attack was the most severe on record, but this fact was of material assistance in rejecting strains and selections which, otherwise, would have had to be carried on for further observation.

In order to effect the necessary economy required as a result of a reduced budget, it was necessary to curtail the area under cultivation to a proportionate extent. It being inadvisable to allow any of the land to revert to "veld," a considerable acreage was planted with dolichos beans with the intention of allowing them to shatter in the hope that self-sown crops will materialise in subsequent years. How far this experiment in economy will be successful remains to be seen.

Fertiliser and spacing trials have confirmed the results obtained in previous years.

Selection Work.—More than one half of this year's re-selections are derivatives of the U.4/64 strain. One of the most promising of these, U.4/64/V has been issued to selected growers for further bulking in the present 1932-33 season.

Other important selections which have been made are detailed in the Annual Report submitted to the Empire Cotton Growing Corporation in London, and as this will be published in due course, there is no need to specifically mention them here.

Buildings.—The new laboratory was completed during the year under review, and properly equipped with electric light, which has also been extended to other buildings on the Station. The Staff of the Empire Cotton Growing Corporation operating in Southern Rhodesia take this opportunity of making grateful acknowledgement to the Government for the provision of these facilities.

Acreage and Yield.—At time of writing the exact acreage which was planted to cotton is not available, but as antici-

pated it is known to be considerably less than that of the previous year, in addition to which a considerable acreage must have been abandoned owing to unremunerative prices combined with low yields.

The total amount of seed cotton harvested amounted to 660,794 lbs. compared with 2,708,997 lbs. the previous year. This is equivalent to 579 Empire bales of 400 lbs.

Further Outlook.—At the time of writing it is very difficult to state what the position of the cotton growing industry is likely to be in the next year or two. Owing to low prices the acreage planted to cotton has been reduced and it is anticipated that there will be a still further reduction this year. It must be remembered, however, that those associated with the furtherance of the industry have studiously avoided any measures which might savour of propaganda, preferring to let the crop establish itself on its own merits. Neither has it been considered necessary to advocate artificial measures to enhance prices. A limited number of growers are beginning to realise that even at to-day's low prices cotton can still be made a payable crop. In certain outlying districts where, hitherto maize has been the staple crop, it is not now possible to grow it at a profit and some alternative will have to be found. So far, there is only one alternative on the horizon, and that is cotton. The time seems ripe for considering the feasibility or otherwise of encouraging natives to grow cotton. The outlook in this direction should be promising, as several of the Native Reserves are situated in areas which are undoubtedly suited to cotton growing. In the event of it being decided to follow up this line of cotton development, it will be necessary to do so with caution, and careful organisation will be required in order to ensure satisfactory marketing facilities.

The Poultry Industry of Southern Rhodesia.

Information supplied by

THE GOVERNMENT STATISTICAL BUREAU.

As a supplement to general farming as well as an industry on its own, poultry farming is becoming more generally recognised as a revenue producing activity, though mainly at present in the production of eggs. There is a certain local market for table poultry, but at present no figures are available of the extent of this trade, which undoubtedly is to some extent affected by the hawking of birds for sale by natives. Large quantities of native bred birds are annually disposed of throughout the country, and it is noticeable that there has been a distinct improvement in their size of late years. While these cannot compare for table purposes with the European bred article, their size and low price make them a suitable change in the menu, especially of a small household.

Increase of Stock.—While the figures collected undoubtedly include all the main owners of poultry in the Colony, they do not represent a complete census of all poultry, as it is not possible to obtain details of the many small pens kept for home use by individuals in towns or persons living on plots, etc., adjacent to the towns, or even of some of the smaller commercial flocks owned by persons living within Municipalities or other urban areas. The totals, however, give a very fair indication of the extent to which poultry keeping is practised in the Colony and indicate a considerable extension of this industry during the last four years.

In 1914 the total poultry reported numbered 117,262 birds, and by 1928 this had only increased to 189,223. The year 1929 saw the turning point in the industry, the total number increasing that year to 242,356 birds, and at the 31st December, 1932, there were stated to be 266,700 birds in the Colony,

exclusive of the above-mentioned small owners in urban areas. In the eighteen years between 1914 and 1932, therefore, the number had increased by 149,438, or 127 per cent.

Composition of Flocks by Varieties.—Up to 1930 it was not possible to distinguish between different types of poultry, but from that year they have been classified under the headings of fowls, ducks, turkeys and geese. In 1932, of the total of 266,700 head of poultry reported, 244,183 were fowls, 11,943 ducks, 9,231 turkeys and 1,343 geese. No attempt has been made to obtain information as to the breeds, but an examination of the exhibits at Agricultural Shows indicate that most well-known breeds are to be found in the country, but as egg production is the main object the lighter breeds, such as Leghorns, with high laying capacity, are mostly favoured, though Rhode Island and Australorps are also extensively bred.

Egg Production.—No figures are available as to the total production of eggs in the Colony, as, apart from eggs produced and consumed by those persons from whom no returns are received, only the eggs sold are recorded by the poultry owners rendering returns. The number of eggs sold reached a maximum of 845,640 dozen in 1931, and though the number sold in 1932 (809,881 dozen) was somewhat less, the numbers recorded as sold during the last four years indicate the greater attention which is being paid to this branch of farming. While there are still periods in the year when eggs for local consumption are comparatively scarce, the total production exceeds the needs of the Colony.

Retail Egg Prices.—Local retail prices of eggs vary considerably with the time of the year and the locality. The scarce season is from January to June, and especially during the months of April and May, when prices range between 2/- and 3/- per dozen. During the latter part of the year prices range from 1/- to 1/6, and at times the average for the months has been as low as 9d. a dozen.

The prices on the United Kingdom market are also subject to heavy seasonal fluctuation, the season of high price corresponding with the flush season in this Colony, thus enabling

export to be made at the most favourable time. Bulk prices for South African eggs on the home market varied during 1932 from 10/- to 15/6 per great hundred (120).

The expansion in the poultry industry necessitates finding markets overseas, at any rate, in the flush season. The United Kingdom provides the most reliable market, and as the season of high prices on that market corresponds with the season of surplus supplies here, this Colony is favourably situated in this respect. While Colonially-produced eggs are admitted into the United Kingdom duty free, this Colony has to bear heavy charges in placing eggs on that market, the cost of cases, containers, railage, shipping and handling charges working out at approximately 6d. per dozen without allowing for the cost of collecting, grading, packing, etc., locally.

As bulk prices for South African eggs on the home market varied from 10/- to 15/6 per great hundred (120) the return to the producer will on the whole be considerably below the average obtained locally.

Imports and Exports.—Import of eggs are frequently made during the scarce season, but the balance of exports over imports is considerably in favour of the former. The principal market for Southern Rhodesian eggs is in Northern Rhodesia, which Colony in 1932 took 174,000 dozen. Small quantities go to other neighbouring territories and 43,000 dozen were exported to the United Kingdom.

Imported eggs are used mainly for cooking purposes, and the average value at which they were imported during the last three years has been 1/4 per dozen (valued f.o.r. senders station). The declared export value during the last three years averaged 1/9 per dozen.

Imports and exports of birds are small and fell off considerably in 1932, a result entirely due to foot and mouth disease restrictions.

Sex Linkage in Poultry.

A LIST OF SUITABLE CROSSES.

Issued by the Poultry Division.

LIGHT SUSSEX.

Light Sussex hens, with males of the following breeds:—

Rhode Island Red	Marsh Daisies
Brown Leghorn	Red Sussex
Buff Rock	Brown Sussex
Buff Leghorn	Buff Orpington
Barnevelder	Welsummer

Of these crosses the Rhode Island Red, the Brown Leghorn and the Buff Leghorn only are recommended, where good egg production and table qualities are desired; and the Brown Sussex where it is desirable to obtain an exceptional table bird.

WYANDOTTE.

White Wyandotee hens crossed with:—

Rhode Island Red	Buff Leghorn
Buff Rock	Old English Pheasant Fowl
Brown Leghorn	

With these crosses there is always a margin of error which may be up to 20 per cent., but in each case the pullets are prolific layers. The Buff Rock as a cross with the White Wyandotte is not recommended.

OTHER GOLD-SILVER CROSSES.

Other Gold-Silver crosses which are not recommended are :—

Male.		*Female.*
Brown Leghorn	X	Duckwing Leghorn
Gold Campine	X	Silver Campine
Gold-laced Wyandotte	X	Silver-laced Wyandotte
Gold-laced or Pencilled Hamburgh.	X	Silver-laced or Pencilled Hamburgh.

These are of more scientific than practical interest.

Black Leghorn	X	Barred Rock
Black Leghorn	X	Cuckoo Leghorn

Both these crosses give excellent layers, the pullets are black with dusky legs, and are active, vigorous birds.

White Breese	X	Light Sussex

This gives an excellent table bird, but from a sex-linked point of view it is not very reliable.

Indian Game	X	Light Sussex

This cross may be used if an exceptional table bird is required. There are several other sex-linked crosses which are not of practical value to the poultry farmer.

Locust Invasion, 1933.

SOUTHERN RHODESIA.

Monthly Report No. 8, July, 1933.

1. **Locusta migratoria migratorioides** (Rch. and Frm.).—Neither reports nor specimens of the tropical form of the European migratory locust were received during the month.

The last survivors (all females) of adult specimens kept in cages since late in March died during July.

2. **Nomadacris septemfasciata** (Serv.).—Most reports of flying swarms of the Red Locust came from the more low-lying parts of the country. No definite migration was observed, and no swarms were noted to be flying high.

In a few cases winter cereal crops were stated to have been damaged, but, in general, threatened attacks were warded off successfully. As certain forest trees (e.g., *Brachystegia*) are expected to flush in August and to provide an adequate source of moisture for locusts, it is hoped that even less damage will be done during the remainder of the season.

Specimens taken from swarms during the month were red in colour, with the pink suffusion at the base of the hind wings about half developed.

MERVYN C. MOSSOP,
Entomologist.

Southern Rhodesia Veterinary Report.

JUNE, 1933.

AFRICAN COAST FEVER.

No mortality at any of the existing centres of infection.

TRYPANOSOMIASIS.

Twenty-seven head of cattle showed infection during the month, and a few cases also in cattle from the Gatooma and Sinoia areas.

CANINE PIROPLASMOSIS.

Very prevalent in the Umtali district.

MALLEIN TEST.

Seven horses were tested on importation with negative results.

TUBERCULAR TEST.

Two bulls *ex* Great Britain were tested with negative results.

EXPORTATIONS.

To United Kingdom as Cold Storage beef:—*Via* Cape Town: Forequarters, 3,476; hindquarters, 3,649. *Via* Durban: Livers, 16,873 lbs.; tongues, 2,590 lbs.; hearts, 5,045 lbs.; skirts, 1,949 lbs.; tails, 8,661 lbs.

Southern Rhodesia Weather Bureau.

JULY, 1933.

Pressure.—Mean barometric pressure was a little above normal. The highs during the month were numerous, but had little effect on the weather, except on the 18th, 28th and 31st, when there were strong winds and overcast skies.

Temperature.—The month was very mild. No extreme cold was experienced, while there were quite a number of warm days. Maximum, minimum and mean temperatures were all above normal, more particularly in the south, where the excess was as much as 3° F. Temperatures in Salisbury were about 1° above the normal, while in the Hartley district they varied very little from the normal.

Rain.—There was no rain, apart from orographic drizzle in the south-east and east of the country.

JULY, 1933.

Station.	Pressure Millibars, 8.30 a.m.		Temperature in Stevenson Screen °F.								Rel. Hum.	Dew Point	Cloud Amt.	Precipitation.			Altitude (Feet)
			Absolute.		Mean.												
	Mean.	Normal.	Max.	Min.	Max.	Min.	½ Max. Min.	Normal.	Dry Bulb.	Wet Bulb.	%	F.	0-10	Ins.	Normal	No. of Days	
Bulawayo	874.2	873.6	80	35	71.7	45.1	58.4	56.8	57.6	49.5	55	42	0.9	Nil	.06	...	4,425
Gwelo	868.1	...	80	36	71.7	43.9	57.8	55.5	54.7	48.5	63	43	1.3	Nil	.02	...	4,627
Riverbank...	...	...	89	37	79.4	45.2	62.3	58.7	53.9	47.5	62	41	...	Nil	.01	...	4,090
Essexvale	...	...	91	33	80.1	42.1	61.0	57.1	50.3	46.2	73	42	...	.04	.11	1	3,817
Gwanda	912.2	...	85	35	74.1	46.3	60.2	...	57.4	50.5	62	44	1.1	...	.08	...	3,228
Nuanetsi	969.3	...	88	...	77.7	...	...	..	59.5	53.2	65	47	2.7	...	.30	...	1,650
Between Rivers ...	...	...	84	32	76.6	38.8	57.7	...	52.4	48.0	73	44	0.5	Nil	.15	...	3,960
Enkeldoorn	862.8	...	79	39	70.3	44.4	57.4	56.1	56.7	50.3	63	44	1.9	.01	.09	1	4,800
Gatooma	...	...	83	36	76.3	42.3	59.3	59.1	55.0	49.1	66	44	0.4	Nil	.02	...	3,870
Miami	884.0	...	79	41	71.5	45.7	58.6	...	59.5	51.9	59	45	0.7	Nil	.10	...	4,077
Salisbury	859.8	859.8	78	35	71.0	43.9	57.5	56.3	57.0	49.7	59	43	0.8	Nil	.03	...	4,885
Sinoia	893.3	...	83	33	75.6	38.4	57.0	...	56.4	50.0	63	44	0.4	Nil	.03	...	3,793
Sipolilo...	890.4	...	80	38	71.5	46.5	59.0	...	59.3	52.5	64	47	...	Nil	.03	...	3,890
Mtoko	883.0	...	80	43	71.3	49.0	60.1	...	59.7	52.7	62	47	1.9	Nil	.03	...	4,190
Inyanga	841.0	...	77	33	66.1	42.5	54.3	...	56.4	47.8	52	39	0.9	...	.15	...	5,520
Bindura...	897.2	...	80	35	72.9	43.6	58.3	...	56.0	50.1	66	45	1.2	Nil	.05	...	3,800
Angus Ranch... ...	...	...	86	43	75.1	49.6	62.4	60.4	56.5	52.7	78	50	...	.06	.15	1	2,300
New Year's Gift...	...	...	89	39	75.5	49.3	62.4	...	58.1	52.7	70	48	...	.22	.24	4	2,690
Rusape...	867.1	...	77	35	68.9	40.4	54.6	...	53.7	48.4	68	44	1.3	Nil	.29	...	4,630
Riverdene North	...	...	85	29	75.7	37.9	56.8	...	50.2	46.9	78	44	...	.10	.15	3	3,700
Stapleford...	...	...	71	30	60.9	39.9	50.4	...	50.9	...	...	...	3.3	1.14	1.20	3	5,290
Umtali...	898.9	898.4	82	42	70.9	48.8	59.8	58.4	59.2	53.8	70	50	2.8	.40	.27	6	3,670
Victoria	901.3	901.9	82	35	72.4	44.1	58.2	55.0	56.5	50.7	67	45	1.6	.04	.10	1	3,570
Mount Selinda ...	...	...	78	44	68.3	50.3	59.3	...	57.4	53.4	77	50	2.7	1.16	1.01	6	3,510

Farming Calendar.

SEPTEMBER.

BEE-KEEPING.

This is an important month for the bee-keeper, as it starts the first flow of the season. All hives that were sent into winter quarters on a double brood chamber, or otherwise with ample food for that period, should now be overflowing with young in all stages and with a population large enough to take full advantage of the flow. All hives should be carefully examined now and again, entrances opened out to suit the advancing warmth of the weather, and where necessary ventilator lids replaced on the top crates under the hive lid. See that no worry is caused to the bees by ants getting up, and that ample stores of good water (with a pinch of salt and a dash of vinegar) are available for drinking purposes, of which bees consume quite a lot. Swarms can now be looked for; if not required, they can best be destroyed by carbon bisulphide or calcium cynaide—both requiring very careful handling. If it is wanted to increase the apiary, as soon as the scouts are seen looking round for a home, get the decoy hive ready filled with dummy and proper frames of full foundation sheets, or, better still, if they are available, old drawn out brood combs, and as soon as it is taken possession of, insert if possible a frame or two of unsealed brood. As a rule the swarm will settle down at once. Such a colony is best placed in the apiary the same evening, if it can be so arranged. Do not make the mistake so often seen of supplying the new colony with starter frames only; give them full foundation sheets; it pays every time, and more especially so in the first early honey flow. Be sure also and protect the apiary against that persistent robber, the honey bear or ratel, by fencing it with fowl netting and pegging that down with wooden pegs every two feet. The two-footed robber can be just as effectively dealt with by placing a small light chain round the entire hive fastened with small staples and a padlock.

CITRUS FRUITS.

The fate of the citrus fruit crop is dependent upon the treatment the trees receive during this month. If the trees have been given the treatment recommended in the August calendar, and this treatment is followed by good irrigations and cultivation, a good crop of fruit may be expected, whereas a total failure will be the result if the trees suffer for want of moisture at this season of the year.

If not already done, all top worked trees should be headed back early in the month. This cutting back will induce the dormant buds (set in autumn) to commence growth. As the new shoots develop the old tops may be further shortened back until the old top is displaced with a new but profitable one.

The packing of late varieties must be speeded up and completed, if possible, by the end of the month, as the late picked fruit is likely to deteriorate in quality or come into competition with Mediterranean fruits.

All adventitious shoots (water shoots and suckers) must be cut off as they appear, and this work should be continued throughout the growing season.

CROPS.

Utilise your labour to the fullest extent for stumping and clearing more land for mixed crops and for general farm development. Do not be satisfied unless each year sees more profit-earning development work effected. Good organisation of the farm work will permit of much being done without great cost. Begin marking out holes for hand check-row planting of maize, and apply manure or fertiliser. Fertilisers which are to be broadcasted and ploughed or harrowed in can be applied. Do not forget that lands which have been green manured in March or April will require a second ploughing about this date or before being seeded to crops. Early varieties of winter cereals ripen this month and require harvesting. Danger from frost should be past now, and crops susceptible to frost, such as potatoes, onions in beds for the summer crop and Jerusalem artichokes, may be planted where lands are moist. Pumpkins and early maize may be planted on vlei lands. Edible canna may be planted "dry" during the latter half of this month, where some rains may be expected during next month. Overhaul all implements and replace worn parts. Putting this off till the planting season may mean serious loss of planting opportunities between rains. Get out the planters and seed drills. Overhaul and place them in proper working order. Ploughing and cross-ploughing should be hurried on with; also the ploughing under of farmyard manure. A spiked roller can usefully be employed for breaking down clods, particularly on those lands which are to be planted first. Make every effort to secure as good a seed-bed as possible; good seed-beds mean good stands, and good stands are all-important in securing good yields.

DAIRYING.

This is generally the quietest month of the year from a dairying standpoint. Most farmers have by this time exhausted their supplies of winter feed and the production of dairy products is consequently at its minimum. Town milk supplies are now falling off, and a greater use of purchased concentrates in the form of ground nut cake and bran is advisable to keep up the milk supply. Very little cheese is made during this month and stocks are naturally low. Old cheese should be cleared out of the storeroom before the advent of hot weather, and if possible should be sent to be stored under cold storage conditions. Considerable difficulty is to be expected in making butter during this month, as the early spring grass is shooting in the vleis and the butter is consequently very soft. To counteract this, greater use should be made of cotton seed cake, of which a small supply is expected to be available this season.

DECIDUOUS FRUITS.

Newly planted trees must not be permitted to become too dry; watering by hand or gravitation must be continued until the rains commence. Ten gallons of water every fourteen days is sufficient for young trees; these applications should be followed by the loosening of the soil to prevent undue evaporation of the added moisture.

All undesirable growths on the stem and in the centre of the trees should be suppressed as they appear; this will enable the retained shoots to develop normally.

Early fruits must be thinned out this month; only retain two or three fruits on each bearing twig or shoot. Those that are left will then develop into large and attractive fruits.

ENTOMOLOGICAL.

Cotton.—Prevention for most of the boll-worms will be the proper preparation of the ground, with thorough cultivation and eradication of all weeds on the land, particularly those of the family Hibiscus. Wild host plants for stainers should be sought out and destroyed.

Tobacco.—Young plants in seed-beds may suffer from cutworms. Frequent cultivation and laying down of poisoned bait—50 lbs. bran and 21 lbs. Paris green; bring to consistency of a stiff dough, adding water when necessary. Distribute this over the seed-beds in the forenoon, as the cutworm does most of its feeding at night. The beds should be thoroughly burnt over with wood or dry tobacco stalks to ensure that the seed-beds are free from cutworms, and baiting for any coming in from the surrounding ground should then be resorted to when the plants appear. Clear the ground for some distance round the beds, say 30 yards in all directions, and bait this ground thoroughly before sowing—this clearance allows a wide margin over which the cutworms would have to travel. Cutworms' moths are nocturnal in habit, so that the coverings of the beds need to be moth-proof at night; this should be seen to each evening.

Potato.—Early potatoes are liable to suffer from caterpillars. The crop should be sprayed at first sign of injury with an arsenical wash.

Cabbage.—During this month the most prominent enemies of plants of this family are diamond-back moth and web-worm. Cabbage louse is sometimes troublesome. The young plants may be sprayed or dusted with an arsenical compound for the former, and sprayed with tobacco wash and soap for the latter.

Beans.—Planted under irrigation during September usually escape serious infestation with stem maggot.

Citrus.—Throughout the month lime-sulphur spray (1-100) may be used to control yellow citrus thrip whilst on every young fruit. A useful spray against black aphis and thrip is the following:—Nictone, 9 ozs.; Capex spreader, 7 ozs.; water, 100 gallons; Capex lime-sulphur, 1 gallon. This may be sprayed or fumigated against scale insects, having regard, however, to presence of fruit and blossom. Spraying and fumigating for scale should not be carried out whilst trees are in blossom. Clear young growth of aphis previous to blossoming, using nicotine, tobacco wash or Derris.

FLOWER GARDEN.

Cultivate extensively to prevent evaporation and to keep weeds in check. Water plants newly set out, especially such as have their roots near the surface. Thin and regulate growing shoots on roses and various shrubs. Plant out cannas and chrysanthemums (for massing and border decorations) and other herbaceous plants.

VEGETABLE GARDEN.

Sow French beans, leek, spinach, cucumber, egg plant, celery, rhubarb, melons and tomatoes. Small sowings of peas, turnips, beet, lettuce, radish, carrot, parsnip and cabbage may be made now.

FORESTRY.

All cuttings struck in sand in July and not yet transplanted into good soil should have this done as soon as possible. Preliminary sowings of eucalypt seeds should now be made on a small scale, so that transplants will be ready in case the first half of the rainy season should prove favourable; otherwise, bulk sowings should be postponed to October-November.

GENERAL.

Indigenuous labour is apt to become more scarce at this time of the year, the boys returning to their kraals to break up the land for next season. Stock are liable to stray in search of the young grass now coming up, and much trouble from this cause is to be looked for on unfenced farms. Natives are now cultivating their gardens preparatory to sowing their crops, which they do much earlier than do Europeans. The mischief caused by veld burning becomes apparent from this time onwards in the condition of the stock, and it is necessary frequently to move them away in search of grazing.

POULTRY.

The supply of green food to the birds must be kept up; in fact, during the hot weather they require more.

During our dry season the available supply of such green foods as lettuce, cabbages, sunflower leaves is much reduced, but there are many others that can be used, such as belhambra, plumbago, wild cockscomb, plantain leaves, paw-paw leaves, etc. Sprouted oats, barley and wheat should also be used. Many of the young cockerels should now be fit for killing. Keep the best and get rid of the remainder. It is very advisable to caponise all young cockerels when about 2½ lbs. weight. The "Rhodesia Agricultural Journal" of October, 1924, and Bulletin No. 517 give clear and concise details as to the method of performing the operation. Some of the earliest hatched young pullets will show signs of commencing to lay now. No light breed bird should lay until it is 5 to 5½ months old, or a heavy breed until it is 6 to 6½ months old. Should any show signs of commencing to lay before this, they should be moved from run to run to prevent their doing so. A bird that lays before it is fully matured will stop growing, will always be small, and its eggs will for its first year of laying also be small.

When the pullets are four months old, i.e., those of the light breeds, they should be put into their permanent laying quarters, and those of the heavy breeds when they are five months old. A bird that is moved after it has started to lay will stop and very probably go into a moult.

See that young ducklings get plenty of shade during the hot weather. Those destined for killing should not be allowed free range or even a medium-sized run, but should be kept fairly crowded in small runs. It is necessary to get the flesh on them as quickly as possible, and the more rest and less exercise they have, the more rapid will be the growth, and also more succulent and tender the flesh.

The hatching of turkeys should proceed rapidly and be carried on until the end of the dry season. See that they have plenty of chopped onions or onion tops or eschalots, and thick separated milk. These are absolutely necessary if the turkey breeder wishes to be successful with his rearing. Do not give wet food; dry mash such as given to chickens is the better.

STOCK.

Cattle.—Ranching cattle should require little now in a normal season; it is only in the event of very late rains that trouble should be expected. Where possible, it will be wise to keep an eye on those cows that may be expected to calve early, with a view to feeding them if necessary and seeing that they do not get too poor. The supplementary feeding of ranch stock is always a difficult problem. But a small provision of cotton seed, good veld hay, kaffir corn or sunflower silage at this time may be the means of saving many head of cattle when the rains are late. This is a critical month for young stock. Weaning should be completed as soon as conditions permit. The dairyman will carry on much as in August; he will, however, use his discretion (in accordance with the condition of his veld) as to the use of ensilage, pumpkins or other bulky and succulent food. He will be wise not to shorten the supply of concentrated foods for some time to come. A little hay or ensilage should still be kept in reserve until the rains have fallen in reasonable abundance. The object should be to build up the condition of the cows expected to calve when the rains come.

Sheep.—The remarks for August apply. Feed up and shear the rams ready for mating for winter lambs.

TOBACCO.

Hasten the preparation of seed-beds for flue cured type of tobacco. The first batch of beds should be seeded about mid-September; subsequent seeding of the remaining seed-beds should be done (in batches) at fortnightly intervals. The last lot of beds normally is sown by the end of October. Seed-beds for dark fire cured type of tobacco should be prepared for seeding which commences after the first week in October.

VETERINARY.

There should be very few deaths from redwater and gallsickness this month. Cases of vegetable poisoning of stock picking up tempting young green shoots of dangerous character on the burnt veld are of frequent occurrence. Sheep can be inoculated against blue tongue, but ewes in lamb should not be treated, on account of the danger of abortion. Scab may be prevalent.

WEATHER.

The temperature may be expected to rise steadily during this month. Rains are not due until next month, though the average over a period of years shows slightly more than in the previous four months, and ranges between .1 and .5 inch. Frost has been known to occur in September, although this is a very unusual event. Rain-gauges should be seen to before the rains commence. They should be carefully adjusted to stand exactly level with the lip four feet above ground, and care should be taken that no tree, building or other obstruction interferes with the fair precipitation of rain into the orifice.

OCTOBER.

BEE-KEEPING.

Bush bloom is now on, the queens consequently are laying vigorously, therefore give space and ventilation. In good districts, where stocks are strong, nectar may be coming in freely, and to prevent swarming it may be necessary to remove a crate of honey. By using the carbolic cloth, the operation is easily and quickly accomplished. At this season, whenever a crate of honey is removed, a properly fitted empty crate must take its place, otherwise the bees will swarm. Keep the apiary clear of weeds, and all hives well shaded. Feed any weak stocks.

CITRUS FRUITS.

Citrus trees should not be permitted to suffer for want of water if a good setting of fruit is desired. Continue irrigation at fairly frequent intervals, especially if it is windy. Cultivation must follow each irrigation when the soil is fit to work, otherwise a large amount of moisture will be lost by evaporation. The packing of late fruit for export should be completed early in the month or before the rains commence. If rains intervene, the carrying properties will be affected and the fruit will probably break down in transit. Suppress all stem growths or water shoots as they appear. Young trees planted last season may with advantage have the stems whitewashed or washed with Bordeaux mixture paste; this will prevent undue sun-scalding of the unprotected stems. Plant cover crops with the first good rains.

CROPS.

If not already attended to, overhaul all farming implements and replace worn parts to ensure efficiency. Shell ground nuts required for the season's planting. Ploughing of old lands should, at latest, be finished this month. If seed potatoes will not keep in good condition until next month, they may be planted now, but later planting is better. Edible canna may be planted this month before rain falls. Also velvet beans, dolichos beans and sunn hemp towards the end of the month for green manuring. Harvest winter cereals and plough under the stubbles as soon as possible after harvest. When rains have fallen, use every effort to improve the tilth of the lands which will be the first to be planted. On cloddy lands already ploughed, seize the opportunity to break down the clods by disc and drag harrowing as showers of rain fall. A spiked roller is very useful for this work. A good tilth means good planting, and a good stand of maize; therefore, do everything possible by cross ploughing, disc and drag harrowing to bring the soil into good condition for seeding.

When necessary, keep the harrows going to check early weed growth. Clean lands at this time of year are an insurance against cutworm and other insect pests. If weather conditions permit, plant a trap crop of maize to attract the stalk borer. New land to be ploughed and intended for planting this season should be cleared of heavy grass or weeds by burning or cutting to ensure good work being done by the ploughs.

Seasonal showers of rain are liable to spoil bricks unburned. See that bricks which have been made are protected from rain. Clean out guttering and down-spouts of house and farm buildings. Press on with development work so as to have this completed before rains break.

DAIRYING.

During the month of October and until such time as the rains have commenced and green grazing is available, dairy stocks require to be almost entirely stall fed. Cows in milk and cows due to calve should be liberally fed on succulents and concentrates in order that they may commence the dairying season in good condition, and make full use of the early grazing for milk production. Dairy cows that are underfed at this time of the year invariably produce milk of poor quality, and usually throw weedy undersized calves; furthermore, they do not pick up in condition until comparatively late in the season.

During October, the cow's ration should consist of succulents such as silage or green feed, etc., legume hay of good quality and a liberal allowance of concentrates; a pound or so of a feed such as ground-nut cake is invaluable for dairy stock at this time of the year.

Weather conditions are generally fairly warm during the month of October, and every precaution should be taken to keep the cream, which is used for butter-making or which is sent to the creamery, as cool as possible. The can or bucket containing the cream should be placed in a basin of water or concrete trough, in the dairy, and exposed to a draught; a piece of kaffir blanket, which dips into the water, should be wrapped around the can or bucket containing the cream. Churning of cream for butter-making is best carried out early in the morning—before sunrise if possible; the coolest water obtainable should be used for washing the butter whilst in the granular stage.

At this season of the year cheese-makers may find that the milk is deficient in butter fat; this is generally the result of under-feeding or unsuitable feeding. Cheese made from milk of low fat content is invariably dry and hard, defects that are accentuated by over cooking the curd or by cooking at too high a temperature. The curd should be firmed in the whey at a temperature not higher than 98° F. to 100° F.

DECIDUOUS FRUITS.

Keep all trees well watered until the rains commence; cultivate after each watering to prevent evaporation of added moisture. Rub off all undesirable shoots, such as those arising on the main stem near the ground; also those shoots having a tendency to crowd each other. Two or more shoots should not be allowed to develop from the same spot on any part of the tree. Rub off the weaker ones soon after they appear. The fruit of early peach trees should be thinned out if a heavy crop has set; this thinning will result in a crop of large-sized fruit. All fruit should be thinned out if necessary.

ENTOMOLOGICAL.

Maize.—Where circumstances permit early growth of maize crops planted late in October are liable to suffer in December from stalk-borer, especially if only a few acres are involved. If maize can be planted early in October, the plants are usually large enough in December to outgrow serious damage. Maize beetle is now in its pupal stage. Thorough working and smashing up of the soil at this time will destroy great numbers.

Tobacco.—See notes for last month, together with article in the "Rhodesia Agricultural Journal" for October, 1926, on "Baiting of Tobacco Seed Beds with Cyanogas Calcium Cyanide." The lands must be kept free from all weeds which caterpillars may feed on, and it is well not to have maize, tomato and Cape gooseberries near the lands; a clearing of some depth is advisable, which must be regularly weeded. If poisoned bait is put down, it has been found that a covering of sacking or leaves will help to retain moisture and thus give further attraction, especially at this time of the year. In order to lessen the heavy infestation of caterpillars and other insect pests in the seed beds, coverings of hessian or cheese cloth should be kept over beds, especially at night; cutworm moths are nocturnal in habit, so that the coverings of the beds need to be moth-proof at night. Notwithstanding precautions in the covering of the beds, insects will enter, and after the emergence of the seedlings a weekly spraying should be carried out. Lead arsenate at the rate of 1½ ozs. (powder) or 3 ozs. (paste) in a 4-gallon petrol tin can be sprayed on the plants once a week to keep insect pests in check. Lead arsenate can be safely used with Bordeaux mixture, the constituents not reacting upon one another. The two combined sprays act as a preventative and deterrent to insect and fungoid troubles.

Cotton.—Thorough cultivation and keeping down of weeds should be resorted to in order to lessen the infestation of over-wintering pupæ, by exposure to the sun, and birds.

Potato.—Avoid introducing root gallworm and potato diseases to valuable land under irrigation or to the home garden with seed potatoes. Growing plants in October may be defoliated by caterpillars, or the tops severely injured by the potato tuber moth. Spray with arsenate of lead (powder), 1 lb. to 30 gallons of water; or (paste), 1 lb. to 16 gallons of water.

Cabbage, Turnip, etc., are apt to suffer severely from diamond back moth and webworm. Dust regularly with Paris green, 1 lb.; fresh water-slaked lime, 20 lbs. For cabbage aphis, water liberally, and wash plants regularly with a forceful stream of water from a hose or spray pump.

Beans and Peas are little attacked by insects at this time of year. If aphis (green fly) is troublesome, the plants may be sprayed with soap wash or tobacco wash. Leaf-eating beetles are best destroyed by hand.

Cucumbers, Marrows, etc., may be attacked by leaf-eating beetles, which quickly destroy the young plants. The young plants may be protected by gauze covers. Once vigorous growth has started, the damage is negligible.

Citrus.—All out-of-season fruit should be removed by this time. Destroy all fruit "struck" by the false codling moth. Aphis may be controlled by very careful spraying with the combined "Lime-Sulphur-Nicotine" spray (for details see "Rhodesia Agricultural Journal," September, 1926, page 871), while the yellow thrip may also be kept in check by this spray. Avoid using miscible oils for citrus spraying. A careful search should be made for the American bollworm (*Heliothis obsoleta*).

Deciduous Fruit Trees, including grape vines, are liable to attack by chafer beetles. Heavy spraying with lead arsenate (paste), 1 lb. to 10 gallons of water, or (powder), 1 lb. to 20 gallons, appears to afford considerable protection, but the leaves need thoroughly coating.

Fig.—Fruit infested with fig weevil should be collected regularly and destroyed.

FLOWER GARDEN.

All flower seeds, annual and perennial, may be sown as in September. A word or two on open seed beds may not be out of place here. These beds should be prepared in a sheltered position, and the soil should be well and deeply dug. This is most essential, as in this state the soil when once watered is more easily kept moist, and is not so liable to cake. The top dressing should be free from all undecayed vegetable matter, and when sown, the seeds should be covered with a thin dressing of fine light soil, over which a thin covering of grass may be placed to check evaporation. Transplanting from boxes or beds should be done on a dull day or towards evening; the plants should be well watered before being removed, and the roots disturbed as little as possible, care being taken that the latter have their full depth and spread when planting.

VEGETABLE GARDEN.

As in September, nearly all vegetable seeds may be sown. Early potatoes should be earthed up when reaching the height of about eight inches. In planting a small amount of marrow, melon, cucumber, and pumpkin, the writer has found it economical to sow the seed one in a tin and transplant when about four inches high in hills. A few cucumbers planted in this manner yielded nearly 400 a week for about two months. Sweet corn and maize may also be sown this month.

FORESTRY.

The main sowings of Eucalypt (gum) seed should be made either in seed trays or in well prepared seed beds. A well-broken soil forming a fine tilth in the seed bed ensures more successful germination and better plants. If transplants are being used, any seedlings which are ready should be pricked out.

Seedlings in open beds may have their tap roots cut so as to develop fibrous lateral roots, and thus produce good type stocky plants. Remember the plant feeds through its roots, hence the better the root system the healthier the plant and the greater its chances of successful establishment. If conditions are favourable, cross-plough and harrow land for planting broken up in early autumn.

POULTRY.

October is usually a hot month, and poultry keepers should therefore see that their birds have access to shade during the day. At the same time they should have plenty of air. One often sees birds during hot weather sitting under dense bushes, which is almost worse than no shade at all.

All houses should be examined and, if necessary, repaired. It is advisable to repeat the caution that birds must have dry quarters.

Many poultry keepers do not realise the vital necessity of giving their birds, especially the young stock, plenty of succulent green food during the hot weather. It should be cut up and placed in boxes or hoppers about 7.30 a.m. and 5 p.m., and, if very hot, also at noon; it should never be placed in the sun. As much as the birds will eat should be supplied. Lack of it, especially during hot weather, causes a reduced output of eggs, smaller eggs and light-coloured yolks; further, a disease known as "nutritional disease," is likely to affect the birds and cause deaths. The symptoms are much like those of eye roup, without the well-known offensive smell of roup. It is due to the fact that vitamine A, which is present in large amounts in all succulent green foods, and which is so necessary for nutrition, is lacking. There is no doubt that many chickens and fowls die each year from this cause.

Ducks.—These during the hot weather require even more shade than do fowls; they cannot stand the direct rays of the sun nor sultry heat. The houses should always have dry floors, and should be overhauled before the rains commence. Ducks sleeping on damp floors often contract rheumatism and carmp. The floor of the duck house should be raised a few inches, thus ensuring a dry bed.

As many ducklings should be hatched as possible now, provided, of course, there is the prospect of a sale for them at ten weeks old. They thrive best in the wet weather.

Turkeys.—Stop hatching until after the wet season is over. To rear turkeys in the wet weather entails a good deal of time, labour, expense and often losses. Once a young turkey chick gets wet, it will probably die; at any rate, it will never be the same bird it would have been had it not got wet. Give the older turkeys all the range possible; the further afield they go, the better grown birds they become, and less is the expense of feeding. See also that their roosting quarters are water-tight before the rains commence.

STOCK.

Cattle.—Ranching cattle on granite veld will in many instances be in fairly good condition on account of the early grass in the vleis, etc. On the diorite soils and later veld the cattle owner will still have to watch his weaker cattle carefully. In any case all supplies of hay, ensilage, majordas, etc., should be carefully husbanded in anticipation of possible late rains, but at the same time every effort should be made to prevent cattle becoming weak. Dairymen will need to feed highly both with succulents and green foods. Calves should be weaned and branded if this has not already been done, and care should be taken that they do not suffer any serious setback by reason of want of feed. The question of a mineral mixture should receive consideration.

Sheep.—If spring lambs are expected, one should see that the sheep-shed is in order, and that there is a supply of hay, ensilage or mealies for the poorer ewes in the event of late rains. All drinking places should be cleansed out, and care taken that the water supply is sufficient. Ewes for winter lambing should be well looked after, so as to get them up in condition before they are put to the ram next month. General shearing may start, including the April-May lambs.

TOBACCO.

Continue to sow seed beds. Where grass has been put on the seed beds to assist germination of seed a daily inspection should be made, and as soon as the first few plants make their appearance the grass should be raised up a little from the bed in order to prevent the plants growing "spindley." All possible preparation for the coming planting season should be made.

VETERINARY.

White scour is prevalent in spring—November and December—but dipping is eradicating this disease. There is still danger from vegetable poisoning, and it will only disappear when there is plenty of good grass on the veld.

WEATHER.

This is apt to be a hot, dry month, and rather trying, therefore, to man and beast, and the strong winds which blow at this season add to the general discomfort. Evaporation is, as a consequence, at its greatest at this time of year, and dams and pools lose most from this cause. The prevalence of veld fires at this time of year adds to the anxiety of the stock owner.

The rainy season has occasionally started early in October, but for practical purposes it need not be expected before the end of this month. The days are becoming warmer, and often even hot and oppressive. Clouds gradually collect, at first disappearing at sunset, but later becoming more persistent. Sheet lightning is usually frequent, and showers of gradually increasing severity mark that the rainy season has set in. Steps should be taken in advance to provide for the run-off after such torrential rains, otherwise serious loss may result.

The normal rainfall varies from three-quarters of an inch to an inch in the different portions of the country. The rain usually occurs in the form of thunder-showers, which are not long sustained and are fairly local, but the total rainfall experienced during the month does not vary much over the whole country, with the exception of the eastern border, where the rainfall is usually heavier.

Departmental Bulletins.

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REPORTS ON CROP EXPERIMENTS.

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TOBACCO.

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LIVE STOCK.

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Editorial.

Contributions and correspondence regarding subjects affecting the farming industry of Southern Rhodesia are invited. All communications regarding these matters and advertisements should be addressed to:—The Editor, Department of Agriculture, Salisbury.

The Hon. C. S. Jobling, Minister of Agriculture.—We have pleasure in welcoming the new Minister of Agriculture, and hope that his term of office will be a long and successful one. The Hon. C. S. Jobling's experience in farming in the Colony is unexcelled, and should prove to be of the greatest value in directing the Agricultural policy of the country. Perhaps it would be more correct to say formulating a policy rather than directing it, as we are convinced that the time has now arrived when the past experiences in agriculture should be reviewed, and a serious attempt made to lay a sound foundation upon which a permanent industry may be built. Thus far it has been almost experimental; and this applies to all the more

important lines of production, whether livestock or crops, and the amount of experience now available in the Colony is ample to formulate a further policy from which many of the pitfalls can be eliminated. Mr. Jobling is particularly fitted for this purpose. The Department of Agriculture has accumulated a large amount of scientific information which throws light on many of the past failures, and it will be essential to combine the practical experience with the modern scientific outlook if a satisfactory policy is to be formulated. During the last thirty years that our present Minister has been farming in Southern Rhodesia he has probably been more intimately associated with all the varied aspects of Agriculture than most farmers. He has been President of every important farmers' organisation, and has been associated with every Commission of importance during the period. He has on several occasions taken the highest prizes offered on the most important Agricultural Shows; established the first pedigree herd of Hereford cattle and contributed in no small degree to the success so far achieved with tobacco, maize and cotton. Since entering Parliament in 1928 he has done his utmost to further the interests of the farmers of the Colony, and it is a happy coincidence that it should fall to his lot to bring into force the Government's decision regarding the Price of Crown Land Committee's Report, which is the result of his action in Parliament in April, 1932.

Conference of Farming and Mining Interests.—The Government has decided to call a conference of four representatives each of the Farming and Mining Industries to meet in Salisbury on Wednesday, 18th October, with the object of discussing and making recommendations in respect of amendments to the Mining Ordinance which may be considered desirable.

The four Agricultural Unions have been approached to appoint one representative each, and the Hon. the Minister suggested that the representatives selected should actually be farming on "Gold Belt" areas in order that they may be fully conversant with the difficulties which arise between farmers and miners where such conditions obtain.

Retirement of the Chief Veterinary Surgeon.—It is felt that the whole farming population will regret that the time has arrived when Mr. James Sinclair, M.R.C.V.S., is to retire from the service of the Colony. He joined the Veterinary Department in March, 1899, and has held the important post of Chief Veterinary Surgeon since October, 1905. His leave pending retirement began on the first of the present month, and his successor is Mr. G. C. Hooper Sharpe, M.R.C.V.S.

The members of the Department of Agriculture, as distinct from the Veterinary Department, wished to express the high esteem in which Mr. Sinclair is held, and to commemorate the spirit of co-operation in which he has always worked with the members of the Department of Agriculture. Several members still hold pleasant recollections of the days when the two Departments were housed under one roof in the building now known as Jameson House.

A small presentation was therefore arranged on September 11th, and the presentation was made by the Hon. George Mitchell, who referred to the extremely successful service which Mr. Sinclair had rendered during exceptionally difficult times.

Locusts.—Organisation of Farmers Necessary.—No apology is necessary for the fact that this issue is devoted almost completely to locusts. The present locust position is by far the most serious which the Colony has experienced, since it was founded, and, to make matters worse, the bionomics of the Red Wing Locust, which is the species concerned, are not so well known as are those of the Brown Swarm Locust. An attempt has been made to supply some of the missing information and the results are embodied in the articles now printed.

The surrounding territories are now all involved, and those to the north and east, which constitute our greatest danger, are all so heavily infested that very severe invasions from these sources seem to be inevitable. The Department is now increasing its stocks of poison and pumps, and the articles by the Chief Entomologist now published should prove of

exceptional interest to all farmers. The Hon. the Minister urges farmers to increase their acreage of crops which are not particularly relished by locusts. It is well known that the natural food plants of locusts belong to the grass-family, and for this reason it is natural that unless protected maize, wheat, and other cereals are invariably most seriously damaged. It is known, however, that hungry locusts will eat practically anything, including cotton clothes, and that while not usually seriously damaged, tobacco, citrus trees, beans, etc., may be devoured if nothing more attractive is at hand. In Matabeleland particularly, where the supply of winter feed is of such vital importance, every effort should be made to produce a good supply of other crops, as the prospects for maize are certainly not good. Cow peas suggest themselves, as it is known that they do well and are of extraordinary value for the purpose indicated. Unfortunately they are not so generally successful in Mashonaland, because of the damage caused by the Bean Stem Weevil and particularly by the Bean Stem Maggot. Certain farms are known to be comparatively free from these troublesome pests, however, and on these farms, provided that the crop is not planted earlier than January, cowpeas can be grown successfully. The suggestion of increased crops of cowpeas thus mainly concerns Matabeleland, but the necessity of increasing the crops other than maize is, under the present conditions, worthy of careful consideration by the whole Colony.

It is not our intention, however, to imply that an alarmist attitude is to be adopted in the Maize Belt of the Colony. Last season's experience indicates that this is not warranted. The abundant growth of grass at that period of the year provides sufficient food for the hoppers, and appears to be quite as attractive as maize. The actual loss of maize last season was not particularly serious, due to the efforts of the farmers themselves. In a few cases the damage was heavy because it was impossible to deal effectively with the position

with the labour available. A full account of last season's campaign appears in this issue. It will be seen that the Department is anxious to do everything possible to reduce the damage to a minimum, but the success achieved depends very largely upon the co-operation of the farmers.

In fact, the experience gained during the past locust campaign has demonstrated the value of organisation amongst the farmers to combat hoppers. This was particularly apparent in the maize belt districts, where the hoppers were in a position to cause very serious damage.

The system adopted is to divide the farms in a district into wards, the farmers in each ward electing a head. The head of the ward should, if possible, be on the telephone.

The head is the section commander, so to speak, of his ward, and undertakes responsibility for (1) reporting egg-laying and the appearance of hoppers to the Magistrate; (2) informing the Magistrate what supplies are needed; and (3) directing operations within his ward.

The farmers in each ward pool their resources in labour and supplies. If, for example, hoppers hatch out on one farm in close proximity to a crop, the farmer, if he needed additional assistance, would communicate the fact to the head of his ward, who would, if possible, arrange to concentrate available labour, pumps, poison, etc., to deal with these hoppers, before others in less immediately menacing positions were dealt with. In certain circumstances the head of one ward might call on the head of a neighbouring ward for assistance.

It is not possible to state how many farms should constitute a ward. This depends upon their size, distribution, situation and other factors.

This system is commended to the consideration of the farmers as being a considerable improvement on individual effort and likely to result in more effective defence of crops.

The organisation should, of course, be built up in collaboration with the official responsible for control of locust operations in the district concerned.

Vaccine for Horse-sickness Inoculation.—A limited supply of vaccine for the inoculation of horses and mules between the ages of 6 months and 5 years is now available.

The cost of the vaccine is £1 0s.0d. per dose for horses and 10s. per dose for mules.

Orders, accompanied by remittances, should be addressed to The Director of Veterinary Research, P.O. Box 657, Salisbury.

Notes on the Biology and Control of the Red Locust in Southern Rhodesia, 1932-1933.

PART I.

CONTROL OF LOCUSTS.

By R. W. Jack, Chief Entomologist.

It is an unfortunate fact that at the present time little can be accomplished in reference to destruction of locusts during a swarm cycle, except in the hopper stage. With the progress of knowledge and invention it is possible that methods of dealing effectively with winged swarms may be developed, but this is uncertain. In the meantime it is necessary to concentrate on protecting crops and destroying the hoppers. A few remarks referring to methods directed against other stages are, however, included in the following pages.

DESTRUCTION OF EGGS.

The fact that the eggs are laid in the ground and, apart from other considerations, are commonly very difficult to locate with exactitude, limits operations against this stage of the insects very drastically. No general campaign can be based on egg destruction.

There are, however, occasions when individual farmers may be able to accomplish something in the way of egg destruction, if particular and immediate danger to crops is involved in the appearance of hoppers from egg deposits, as for instance when eggs are actually laid in ploughed land.

Some doubt, however, exists as to the efficacy of the methods usually employed with this end in view. The usual recommendation is *ploughing* and *harrowing*, or *disc*

harrowing if the land is already ploughed. This procedure is extensively practised in certain countries, but limited experience in Southern Rhodesia does not suggest more than a partial effect.

In some populous countries *collection* of eggs is largely practised, a reward being paid for a given quantity of egg pods. The method is extremely expensive and the expense out of proportion to the results secured.

At the same time, when a farmer is aware that eggs have been deposited in his land he is in a very difficult position because, in the case of the Red species, the eggs will be usually due to hatch when it is too late to re-plant, and destruction of the hoppers on emergence by means of the standard arsenical spray may involve destruction of a certain portion of the crop.

Farmers have attempted to destroy as many eggs as possible on their lands by discing, followed by gangs of natives to collect the exposed eggs, but the results are only partial and the method generally is not very satisfactory.

Collection of eggs was discarded many years ago in Natal in favour of poisoning the hoppers, when hatched, using a sweetened solution of Arsenite of Soda.

Baits and other methods of destroying hoppers under various conditions are dealt with in the next section.

DESTRUCTION AND CONTROL OF HOPPERS.

1. **Mechanical Destruction.**—Locust hoppers can be and have been destroyed in large numbers by various mechanical devices. The simplest of these methods is beating them down with branches or hand-made wire flails and similar instruments. Rollers, brush drags, etc., have also been utilised to some effect. The usual result of attack on swarms by these methods appears to be destruction of a portion and scattering the remainder. Such methods may, however, be useful on a small scale and in emergency. Flails have been used to some extent in Rhodesia in the case of hoppers hatching out in cultivated land.

In the United States of America a combination of mechanical and chemical destruction is to be found in the machines known as hopper dozers. These consist essentially of a shallow tray on runners with an elevated back and wings. The tray is usually made of galvanised iron and contains crude oil. The machine is dragged through infested grassland, or in some cases crops, and the hoppers as disturbed tend to jump in large numbers into the tray, where the oil kills them. This form of machine is practically useless against swarm locusts, its capacity being far too small, but it is useful against solitary grasshoppers.

A modification is a catching machine which operates on the same general principle, but in place of a tray with oil the hoppers are led into a box at the back whence they can be collected for use as fowl food, etc. The same objection of too limited a capacity for effective use against swarm locust hoppers applies to these machines, but if any farmer desires to use such a machine for collecting hoppers for fowl food, etc., details of construction can be obtained from the Entomological Branch of the Department of Agriculture, Salisbury.

2. **Fire.**—Hoppers can be burnt successfully if they are present in grass which will burn at the required time of year, and many swarms have been destroyed in South Africa by this means. It is obviously only occasionally possible to utilise this method. Grass can, of course, be kept standing for this purpose.

The use of fire has been developed in some countries in the form of *flame throwers* of various types, but the use of these machines has been abandoned in countries which have had most experience with them, on account of the very high cost in operation and also the danger to the operators, several fatal accidents having occurred. In such a country as Southern Rhodesia where the cost of petrol is several times as great as in oil-producing countries, the cost in operation would undoubtedly be very high indeed. The method has been unequivocally condemned in Kenya on the basis of cost. It is, moreover, a method which can only be applied with any degree of safety by trained operators. It has, of course, the

great advantage, compared with poison, that it involves no danger to stock, but the method is not regarded as an economic proposition in Southern Rhodesia.

3. **Ditches and Barriers.**—Ditches and other forms of barriers can be used either (1) to prevent hoppers getting into crops or (2) to destroy hopper swarms.

Ditches need to have vertical sides or to be undercut. They are usually made about two feet square in section and deeper post holes may be sunk every 10 yards or closer. The hoppers tend to collect in the post holes, where they can be readily destroyed.

The digging of ditches, of course, involves a great amount of labour, and in the wet season in Southern Rhodesia the ditches would be liable to destruction, as far as their efficacy is concerned, by flood water. They are only likely to be used for the protection of the lands, but even so, unless the weather is unusually dry, as it was during the latter part of last wet season, the labour may be more or less wasted. It would presumably not be necessary to surround the lands with protective ditches, as the hopper movement in any particular locality seems frequently to take more or less one direction. In hilly country most of the danger to lands appears to come from the hills.

Barriers have been made extensively in the past of small timber and cloth of some sort, but latterly galvanised iron has largely replaced the more flimsy material. A height of about 18 inches and upward above the ground is regarded as sufficient. The pieces may be held together by double pegging at the overlap, by "clenching," or by other devices.

These barriers are used in a variety of ways, which are commonly modified in accordance with the ingenuity of the operator. Holes may be dug at intervals close to the barrier to catch the hoppers, and it is an advantage to overlap the edges of such holes with pieces of galvanised iron to make sure that the hoppers do not get out again. The holes should be about two feet deep and say two feet wide at the top. The sides, of course, should be vertical or slightly undercut. Another method is to form raised enclosures at intervals in

the barrier by making a V-shaped deviation in the barrier itself and completing the square by adding the other two sides also in galvanised iron. These enclosures may be two to three feet square. Earth is heaped up against the sides of the enclosure on the side from which the hoppers are to come. The hoppers scale the incline and jump into the enclosure, where they can be collected or killed. A stick is sometimes placed in the centre of the enclosure. The hoppers tend to climb this and the final result is a conical heap of hoppers convenient for collection or destruction.

The barriers themselves may be made in a V-shape with a wide opening towards the advancing hopper swarm. The converging sides concentrates the hoppers and are usually made to lead to a pit or enclosure.

Anyone possessed of a little ingenuity can use barriers to good effect in protecting lands and even within limits to destroy swarms elsewhere. For land protection in Southern Rhodesia a great amount of material would, however, be required, as maize lands tend to run into hundreds of acres and the expense in the case of galvanised iron would be considerable. The material for a barrier 1 foot 6 inches high would apparently cost about £8 10s. 0d. per 100 yards and there is the labour to be added.

With skilled operators barriers have been used very successfully for trapping swarms. The trap may be erected in front of a moving swarm and the necessary pits or enclosures constructed so that the hoppers are concentrated and caught. The barrier needs to be at right angles to the line of march and needs to be fully wide enough to cover the front of the swarm. It is usual either to make it V-shaped or to construct wings at the ends in the direction from which the swarm is coming.

If barriers are used for this purpose their erection needs to be timed to be completed shortly before the swarm is due to reach it. If the barrier is erected too far off the swarm may change direction before reaching it and the barrier prove useless. It is necessary to avoid disturbing swarms advancing towards a barrier.

Owing to the fact that hopper swarms may continue in the same direction day after day trap barriers may be erected after the swarm has come to rest in the evening,and if properly constructed and situated the whole swarm may be caught and destroyed next day.

Figures cannot be given concerning the size of trap barriers as this depends entirely on the size of the swarm to be caught. Experience is needed in this connection.

The Department has no experience with the use of barriers and barrier traps against any species of locust in Southern Rhodesia and is therefore not in a position to make any definite recommendation. It appears probable that if the grass is at all long it may be necessary to clear a space in front of the barrier, or to mow down the grass, otherwise such a low barrier may fail to arrest the advance of the hoppers.

Chemical Methods.

1. **Contact Insecticides.**—Prior to the discovery of the value of arsenic for locust destruction various preparations which kill the hoppers by contact were used. It is only intended to deal with soap solution in the present article, as this insecticide was at one time used extensively in South Africa and, to judge by the agricultural Press, is still not without its advocates.

Soap solution cannot compare with arsenite of soda solution either in efficiency or cheapness, but it has, of course, the great advantage of being non-poisonous. It is stated in the present standard work on locusts* from which, incidentally, much of the foregoing information has been taken, that "A further disadvantage of all contact insecticides is that they produce goods results only in strong concentration, such as are injurious to plants, and this prevents their use on cultural land." During the past season a number of tests were carried out with strong soap solutions both on hoppers and on maize. The strongest solution used, namely, 2 lbs. of Blue Mottled Soap in 4 gallons of water, in a series of tests resulted in no apparent injury to maize at all, and this is a greater concen-

*Uvarov, B. P., "Locusts and Grasshoppers." The Imperial Bureau of Entomology, London, 1928.

tration than is generally recommended for hopper destruction. At the same time it is necessary to be cautious, because certain preparations may be apparently innocuous to plants under certain conditions and yet produce severe injury under other conditions. During the test in reference the weather was warm and sunny and no tests were made in dull weather.

Hoppers up to the 3rd stage were definitely killed if thoroughly wetted with a solution of 1 lb. yellow soap in 3 gallons of water, but in a series of tests carried out under working conditions by a locust operator the hoppers were reported to be "stunned" at first, but to recover later.

Apparently the soap solution is only effective against very young hoppers, and even these need to be very thoroughly wetted with it.

It is possible that this solution might be used to good effect to destroy newly hatched hoppers on land already bearing a crop, but caution is advised and it is to be realised that the measure is likely to be both laborious and prodigal of soap in the case of the Red Locust. The hoppers of this species do not come together into considerable swarms within a week or more of hatching.

The strength suggested is 1 lb. Blue Mottled or Yellow soap in 3 gallons of water. The soap should be cut into thin flakes and thoroughly dissolved. The water needs to be hot to dissolve the soap rapidly and the solution is best applied whilst still warm.

2. **Poisons.**—Arsenic and its compounds are rightly classed as stomach insecticides, although in locust spraying and dusting arsenite of soda, whether dry or in solution, acts largely as a contact insecticide. In actual fact it appears that under these circumstances we have a double action. The poison kills the insects hit, but the completeness of its action against a swarm is possibly also dependent upon individuals, which are not hit, ingesting the poison either with the grass or the tissues of their dead or dying fellows, or, if still in solution, by drinking it. In this connection it may be noted that the hoppers are cannibalistic and eat their injured, sick and dead

comrades. There is, however, room for further investigation of the exact action of arsenite of soda when used in the field both as a spray and as a dust.

(1) *Spraying with Sodium Arsenite in Solution.*—The arsenite of soda issued by the Department in powder form contains the equivalent of 80 per cent. of white arsenic (arsenious oxide). Owing to its fine state of division, that is, the smallness of the particles, it is readily soluble even in cold water and only needs to be put into the water and stirred thoroughly. Directions for use are given at the end of this article.

The Department has found it necessary, for the present, to adhere to spraying as the main basis of operations on account of the known reliability of this method as compared with *dusting* and *baiting* which are discussed below. Spraying is not always the cheapest method of utilising the toxic properties of arsenite of soda nor necessarily the most suitable, and it may be superseded some time in the future if more economical methods can be proved to be reliable under Southern Rhodesian conditions. It is, however, impossible to prepare for an extensive campaign on the basis of methods concerning the efficacy of which any doubt exists, as the general procedure cannot be changed at short notice.

In connection with spraying it may be stated that in emergency arsenical *cattle dip* makes a very good substitute for the official locust poison. A cattle dip intended to be used at one part in 400 for its original purpose, should be diluted to one part of dip to 160 parts of water for spraying young hoppers. For older hoppers the strength may be as great as one part of dip in 128 parts of water, but this strength should never be exceeded, in view of the danger of stock poisoning.

Pumps.—A certain number of complaints were received during the past campaign concerning the quick wearing out of the packing of the *pumps* supplied by the Department. The pumps were all overhauled before the campaign commenced and a considerable proportion were new. The pumps are being overhauled again in anticipation of the coming season's campaign and a different packing is being used. It appears impossible, however, to fit these small pumps with

packing which will stand a great deal of wear under field conditions, and the farmers and district officials must be prepared to re-pack the pumps when necessary. It is to be realised that effective and economical spraying is impossible if the pump is not in good working order. Replacement of the gland packing and of the packing on the plunger is a simple matter. The main thing to bear in mind is to use plenty of grease. Spare packing will be distributed to the Magistrates, Native Commissioners, etc.

Suggestions have been forwarded to the Department to the effect that knapsack pumps should be supplied in place of the bucket pattern at present issued. Whilst it is admitted that knapsack sprayers have an advantage in mobility, there are various weighty objections to their adoption for this purpose. In the first place, they cost several times as much as the bucket pumps, and in the second place they would not withstand the rough treatment to which locust pumps are unavoidably subjected. They are also bulky and expensive to transport. Finally, the position in which they are carried involves the element of danger if any leak develops, as it is very liable to do either in the tank itself or in the glands. Arsenite of soda in solution has a caustic action on the skin, as many people have experienced, and whilst it is bad enough to be "burnt" about the hands and knees, it is still worse to be "burnt" about the body. Moreover, the possible soaking of clothing with the strong poison appears liable to increase the risk of still more serious accidents, particularly in the case of natives, who are notoriously careless.

It is anticipated that a certain number of more powerful barrel sprayers will be utilised in connection with lorry outfits for Government operations during the coming campaign.

Complaints have also been received to the effect that the nozzles are wasteful in operation, and it has been suggested that nozzles throwing a finer spray should be provided. Regarded from all points of view the present type of nozzle, adjustable and throwing a fan-shaped spray, appears to be the most suitable. A very fine spray is not always advisable for this work. The present nozzles can be adjusted to throw a fine enough spray when distance is not required and can

also be adjusted to throw the liquid for something like forty feet when it is necessary to reach the centre of a considerable swarm of hoppers. Intermediate distances can also be obtained. This cannot be secured with other types of nozzles at the comparatively low pressure furnished by small hand pumps.

It is necessary to instruct native operators carefully in management of the nozzle, otherwise they are liable to use it adjusted at too open an angle for most purposes, and so waste the solution, and increase the danger of stock poisoning. It is also necessary to see that the brass nut at the side of the nozzle is adjusted sufficiently tightly to hold the revolving portion in any position to which it is adjusted, but not so tightly that movement of this part requires serious muscular effort. These nuts are apt to work loose so that this point needs regular attention.

The efficacy of the nozzle depends upon the pump supplying sufficient pressure. The two photographs in Plate I. show a locust pump in action with the standard nozzle supplied (made in Johannesburg). In Plate I., A, the nozzle is adjusted with the hole against the lip and a fine short range spray is produced. In Plate I., B, the nozzle is wide open and it will be noted that with sufficient pressure the stream breaks up and falls as a reasonably fine spray at a considerable distance. This result cannot be produced if the pump is not in good working order. Therefore see that the packing is correct and that the valve balls and seatings are clean.

(2) *Dusting with Arsenite of Soda Powder.*—The use of arsenite of soda as a dry powder to be dusted over the swarms has been mainly developed in the Union of South Africa in connection with operations against the Brown Locust in the drier areas.

The standard packing for the powder consists of six 5 lb. tins in a wooden case. A procedure evolved consists in making three to five holes in one end of the tin with a small nail and shaking out the powder over the swarm to be destroyed. This procedure is decidedly economical because, although it appears to consume more powder than spraying, it does away with the serious items of pumps and transport of water.

During the past campaign this method was tried out both by the entomological staff and by field operators, as well as by certain farmers.

Certain points are apparent as the result of these tests, the most important point being that a certain amount of breeze seems to be necessary for satisfactory work.

In various parts of Southern Rhodesia the air is apt to be very still for considerable periods in the wet season and attempts to dust swarms from tins under these conditions not only proved very difficult but positively dangerous, as it was far from easy to avoid getting the powder distributed freely over one's person. Certain operators, both European and native, suffered severe burning on this account. Also, in still air the coarser particles of the powder at present available tend to fall directly on the ground, which is very dangerous in reference to stock poisoning.

In a moderate breeze the powder, if dry, can readily be distributed over a swarm in short grass, the operators, of course, working always from the windward side.

The method really requires trained operators who know how to use the powder safely and effectively, but apart from this point, conditions in Southern Rhodesia do not appear very favourable to the general adoption of this method. Operations are necessarily carried out in the wet season when the grass is long. The powder absorbs moisture from the atmosphere and the tins are very liable to get wetted in long grass. The holes in the tins tend to clog in these circumstances and the whole undertaking to prove very unsatisfactory. No one reported favourably on the dusting method as compared with spraying during the campaign, hence no endeavour was made towards getting the method widely adopted.

Dusting might be more widely used if a really durable and safe apparatus of a portable type could be devised for the purpose of blowing the powder over a swarm. This is a matter which, it is understood, is receiving attention in the Union of South Africa. In such a case, however, one of the advantages of the pierced tin method, namely, avoidance of the

cost of distributing apparatus, would disappear. Against the advantage of not having to supply water, would have to be set the fact that more powder would probably be required, and more danger to stock would probably be involved (see below under danger).

At present farmers are not advised to attempt dusting operations with ordinary farm labour on account of the danger to stock and to the human skin. Experience is not absolutely necessary to avoid this danger, but a certain standard of intelligence and commonsense is certainly required. The farmer himself or any intelligent European employee might, however, carry a tin of poison when going about the farm, for the purpose of destroying under feasible weather conditions any small swarm encountered.

Concerning the piercing of the tin, it may be noted that the three to five holes are best punched close to the rim at one end and about half an inch from each other.

Before leaving the subject of dusting it may be noted that aeroplanes have been used in Russia and elsewhere for dusting hopper swarms where other conditions are favourable.

(3) *Baiting with Arsenite of Soda.*—Baiting is a method which may be developed and used to a much greater extent in the future. It has been used extensively against solitary grasshoppers in the United States of America for a considerable number of years past and also against swarm locusts in the Union of South Africa and many other countries.

It was the basis on which arsenite of soda was first used as a locust poison in South Africa, the pioneers being certain sugar planters in Natal during the last decade of the past century. The species of locust concerned in these early experiments was the Red Locust. The procedure was to dip green stuff of any sort into a sweetened solution of sodium arsenite and to strew this bait about the haunts of the hoppers, or otherwise to spray the solution over any suitable vegetation favoured by the hoppers, provided, of course, that the vegetation was of no value. The success obtained led to the adoption of a sweetened solution of the poison against the Brown Locust in the Union of South Africa, and for many years this was

the standard poison, and the directions issued by the Department of Agriculture in that dominion were obviously intended, up to the year 1924, at least, to apply to the use of the poison as a bait even though spray pumps were used to distribute it. In the years 1921-22, however, Dr. C. W. Mally, Senior Entomologist, of the Union entomological staff, carried out a highly important investigation which showed, first of all, that in practice against the Brown Locust the liquid was being used more as a contact poison than as a bait, and, secondly, that the addition of molasses or sugar was unnecessary, the poison acting equally well as a plain solution in water without any sweetening agent.

Mally's deductions included further the fact that the sugar or molasses exercised no definite *attraction* on locust hoppers, although it had a distinct "holding" power, and its presence induced the hoppers to feed greedily when they encountered the sprayed grass. A similar holding power was, however, observed in reference to the plain arsenite of soda solution, probably owing to the saline taste.

Consequently, it was decided, when preparing for the campaign against the Brown Locust in Southern Rhodesia in 1924, to avoid the greater expense of the sweetened solution and to use the plain solution only. This decision was fully justified by the campaign which followed and the Colony was saved considerable additional expenditure.

It has been stated that *"the data obtained during a series of campaigns in various countries show conclusively that the use of bait is applicable under any conditions and for any species, and this leaves no room for spraying." This is a distinctly debatable statement. There may, of course, be baits which function satisfactorily against all species of locusts under all conditions, but it is clear that reliance on any known and feasible bait in Southern Rhodesia at present would be a highly injudicious procedure on the part of those responsible for organising the locust campaign.

Experiments with standard baits, such as are used successfully against grasshoppers in the United States of America, have in the past given negative results against these insects

*Uvarov, B. P., *Loc. cit.* p. 188-189.

in Southern Rhodesia. Certain species of cutworms in the Colony do not yield to the standard baits successfully employed in America and elsewhere. The well known method of collecting moths by smearing sugary solutions on tree trunks, fence posts, etc., which is very effective in Britain, is practically useless in this Colony, as the insects are not attracted.

It is obvious that the results of experiments carried out under one set of climatic and vegetational conditions cannot necessarily be applied to another set, nor even the results in a single season to successive seasons in the same country. Baiting needs to be tested out thoroughly in Southern Rhodesia before the question of adopting it as the main basis of operations can be considered from other standpoints.

During the past season good results were obtained with certain baits in dry weather, but in wet weather with a moist soil and a humid environment generally the results were unsatisfactory.

As a matter of fact much uncertainty exists as to what is or may be really attractive about the baits generally used. For instance, wheat bran is commonly recommended as a "carrier" in sweetened grasshopper baits in America, but from a considerable series of experiments by different entomologists in that country it is quite impossible to deduce whether the addition of sugar or molasses is justified or otherwise. If the sweetening agent is unnecessary it would appear that the bran is not simply the "carrier" but also the "attractant." But is this really the case? May not the moisture be the real attractant?

Uvarov states (*loc. cit.*, p. 181) that "the use of poisoned baits is based upon the positive chemotropism of *Acrididae* towards certain substances which are more attractive to them than their normal foodstuffs." The attraction exercised by the existing vegetation is, however, very variable not only from one locality to another but also from one time of year to another.

Obviously the more attractive the vegetation the less attractive the bait and *vice versa*. It is conceivable that the vegetation might be more attractive than the bait, in which

case the latter would be practically useless. Such experience is, in fact, reported from the Union of South Africa and from Kenya.*

It is also obvious that if baits attract mainly on account of their moisture they are likely to be more or less useless if the soil and vegetation are wet.

Locusts are reported to eat dry baits at times, but as Uvarov states (*loc. sit.*) "the drying up of the baits usually lessens their attractiveness." He also states, "in hot dry climates baits attract mainly because they are damp."

Whilst further experiments are planned, it would not be very surprising to find that in Southern Rhodesia the growing grass and usually moist environment during the "hopper season" preclude the general adoption of baiting as a method of locust destruction, although it can undoubtedly be used effectively under favourable conditions.

It is to be observed, however, that poison baits are reported to have been used successfully in Kenya in 1931, and that that Colony has a climate which is not greatly dissimilar to that of Southern Rhodesia. The baits appear to have functioned. to some extent at least, even in wet weather, but a much heavier dressing is recommended under such conditions. Spraying was, however, also employed, and seems to have been regarded as equally economical to baiting, where water was readily available. Baiting was also employed successfully in Northern Rhodesia, but apparently in dry weather.

Whatever the respective economic merits of spraying and baiting, where water is available, there are areas in Southern Rhodesia where considerable water difficulties exist. Further, baiting, if effective, is also more suitable than spraying, when a growing crop is infested. It is possibly in the last mentioned situation that effective baits can be most readily employed.

The main difficulty in respect to baits, apart from the question of their efficacy under all conditions, lies with the

*"Report on the 1931 Locust Invasion on Kenya." Bulletin No. 21 of 1931, Department of Agriculture, Nairobi.

provision of a suitable and sufficiently cheap "carrier." Such carriers as bran and sawdust are out of the question for general use in this Colony, as they are not available locally in sufficient quantities where most required, and would need to be imported, or to be transported over great distances to the important agricultural districts.

As shown by Mr. Mossop's experiments (see Part II.) an apparently suitable carrier exists in considerable quantities in the form of maize cobs (cores) which need to be ground up for use. Unfortunately the supply of maize cobs is scattered about over a large number of farms in the maize belt, and whilst this may prove an advantage to individual maize growers, it does not create a favourable position for the central manufacture of poison bait. The necessary transport would become a very serious item if baiting were to be officially adopted. There are no industries in the Colony which produce suitable waste products in great quantity at any central point.

Farmers who wish to try baiting on their lands may dissolve 3 ozs. of dry arsenite of soda in $2\frac{1}{2}$ gallons of water, and mix this quantity with ground maize cobs (cores) until the latter is thoroughly wet. The quantity of dry ground maize cobs in this case will be about one petrol tin full (4 gallons). This bait can then be strewn amongst the hoppers on the lands or in front of an advancing band of hoppers. Figures from Kenya (*loc. sit.*) indicate that thirty pounds per acre of a somewhat similar bait was sufficient in dry weather, but that fully one hundred pounds per acre was necessary in wet weather.

Utilisation of Natural Enemies and Disease.—It is only necessary to state under this heading that a considerable amount of attention has been devoted by scientific men to the question of controlling locusts by disseminating their natural diseases, without any general success having been attained. A fungus disease (*Empusa grylli*), under certain conditions, is a very powerful factor in helping to bring to an end swarm cycles of the Brown Locust in Southern Africa and may be one of the more important factors in limiting the distribution of that species. It has been found, however, that epidemics of the disease cannot be produced at will, as they are dependent

upon meteorological conditions, particularly humidity and temperature. Also, there does not seem to be much information concerning the susceptibility of the Red Locust to this disease. In view of its habitat it is considered possible that this species is considerably less susceptible than the Brown Locust.

A bacterial disease (*Coccobacillus acridiorum*) discovered in Yucatan in 1910, has also proved a failure in extensive tests.

Certain parasitic flies are effective enemies of locusts and are also regarded as potent factors in eventually reducing swarm cycles. They apparently need several years, however, during a swarm cycle to become a serious factor, and the process cannot be hurried artificially by any method at present known.

WINGED SWARMS.

At present, except where occasional opportunities of utilising grass fires occur, little can be accomplished on an economic basis in reference to the destruction of winged swarms of the Red Locust in Southern Rhodesia. A certain amount of destruction might be brought about by spraying at night, but the swarms commonly cover large areas, resting high on trees, and on shrubs and grass. A few small pumps could do little execution, and it is judged that any appreciable reduction in numbers of winged swarms in the Colony could only be brought about at an uneconomic expenditure.

The main question with winged swarms therefore is protection of crops. The methods used for this purpose include the creation of a disturbance, that is, banging of tins, etc., movement, which may include the waving of brightly coloured flags, and production of a smoke screen. Under certain conditions, particularly in the cooler winter months, when the insects are not very hungry, the winged swarms of the Red Locust are as a general rule easily kept off even green crops by disturbance or a combination of disturbance and smoke smudges. They are, however, by no means so easily kept moving in warmer weather when hungry.

During the past year the greatest amount of damage from winged swarms has been sustained (1) when the invading

swarms were circling preparatory to and during egg-laying in December, and (2) immediately after the swarms had obtained wings and become fully hardened in April. Swarms have also shown a strong tendency to attack irrigated crops, and even citrus and other fruit trees, as early as August.

When the swarms are really hungry only the promptest and most vigorous measures will save the crop or trees. The creation of a disturbance needs no particular directions. This method is practised even by savage tribes.

The production of smoked smudges is a more technical procedure, and a pamphlet giving full directions can be obtained from the Department of Agriculture (Bull. No. 890, May, 1933). Smoke smudges are generally reported to be the most effective method of protection, but reports concerning their failure have been received from time to time, and some growers are inclined to rely more upon disturbance.

One complaint received was to the effect that the chemical smudges which are stated to burn for about 12 minutes did not in practice burn for more than about three minutes. It is, however, stated in the pamphlet referred to above that if the mixture bursts into flame, a few handfuls of sands should be thrown over it to stifle the flame. If this is not done the tins burn out very quickly and do not produce an effective smudge.

DANGER.

Arsenite of Soda is a deadly poison and is also corrosive to the human skin, either as a powedr or in solution. Common-sense and care need to be exercised if accidents and undesirable occurrences are to be avoided.

Natives are apt to be excessively careless in regard to the poison and have even been observed to attempt to drink from vessels which have contained the solution and have not been washed, or in which natives working with the poison have washed their hands.

It is suggested that, as a precaution, vessels used for spraying, usually petrol tins, should be adorned with a strip of red paint to indicate that they are not to be used for drinking or cooking purposes.

The poison and vessels used to contain it should, when not in use, be kept under lock and key, or if this is impossible, kept under adequate supervision. The empty poison tins should either be properly cleansed under supervision or otherwise buried. Appropriate washing, especially before meals, should be insisted upon in the case of native operators, who are apt to be careless in this respect.

There is a real risk of "burning" of the skin due to the corrosive nature of the poison, and this may lead to serious discomfort if nothing more. The hands are, of course, bound to get wetted with the solution, and if operators walk through grass which is wet with the poison the knees and legs may get "burnt" as well, leading sometimes to very nasty sores.

The remedy is to grease the skin, say, with motor oil or grease of any sort, to wash frequently and to avoid as far as possible walking through recently sprayed grass. Natives employed in Government operations are supplied with grease to rub on their arms and legs.

Fatal accidents involving human lives are fortunately extremely rare, but accidents involving loss of cattle and other stock are not so rare, although the losses reported during the past campaign were gratifyingly small, considering the amount of poison which was used.

Cattle may be fatally poisoned by grazing for a sufficient length of time on recently sprayed grass, but the majority of accidents appear to be due to real carelessness or to ignorance.

The saline taste of arsenite of soda is unfortunately agreeable to cattle and other livestock suffering from "salt hunger," a more or less chronic condition of stock in most parts of the Colony.

If soil is saturated with the solution or the powder is spilled on the ground stock will commonly lick up either the soil or the powder in sufficient quantity to obtain a lethal dose. Grass sprayed or dusted with the solution is probably more attractive to grazing animals than unsprayed grass, at least until it has withered, and possibly even then if the animals are salt hungry.

A washing shower of rain removes the danger, and fortunately heavy showers are normally frequent at the time spraying is carried out.

Considerable anxiety was felt towards the latter part of the recent campaign due to the failure of the rains after January and the vast amount of poison which was being used. It was feared that the sprayed areas were likely to remain a danger throughout the dry season, and the Government employees were instructed to burn off as much sprayed veld as possible. The farmers were advised through the Magistrates to do the same.

The Chief Chemist has kindly co-operated with the Entomological Branch in carrying out an investigation of the actual danger to stock involved in spraying against locusts.

This investigation has yielded points of considerable interest, which will be made public in detail later, but for the present it may be stated:—

(1) that burning of the sprayed grass is an effective safeguard against stock poisoning;

(2) that, despite lack of rain, the quantity of arsenic retained on sprayed grass shows progressive decrease, particularly if the spray has not been applied in excessive amount in the first instance.

It has, however, been found from experiment that the minimum fatal dose of arsenic for an ox in the form of arsenite of soda is considerably smaller than available published records have indicated, and there is no doubt that appreciable danger of poisoning exists if animals are allowed access to sprayed herbage before it has been washed clean by rain. In the absence of rain the burning off of sprayed patches is therefore strongly recommended. A further safeguard is to keep the animals well supplied with salt, or a lick containing salt, in order to diminish their "salt hunger."

Directions for preparing and using the poison must be rigidly followed. Danger to stock increases in proportion to the strength of the solution used. There is a very marked tendency to increase the strength of the solution in order to see the hoppers die quickly. There is no advantage in killing

the hoppers any more quickly than is done by the strength laid down. Hoppers will do no serious damage after being sprayed, although they may not die until the next day.

On the other hand, excessive fear of the poison is to be deprecated. During the past campaign certain stock owners stated that they had reason to believe the use of locust poison involved danger to stock on sprayed veld up to ten years afterwards, whilst in another case one mouthful of sprayed grass was stated to have killed a beast before it had walked more than a few hundred yards. Readers of the *Journal* may rest assured that if the use of arsenic to destroy locusts were as dangerous as is indicated by these statements it would not have survived beyond the preliminary experiments, whereas its use has spread widely to practically all countries which suffer from these pests. Spraying with arsenite of soda can be practised with reasonable safety subject only to the adoption of commonsense precautions.

There are no great difficulties if rain falls at reasonable intervals, but it is realised that lack of rain may prove embarassing, as the quantity of sprayed and unwashed veld is liable to increase under such conditions, and a stock owner may be inclined to hold up spraying pending further rain, on account of lack of grazing. In this connection it is to be noted that a real washing shower during which the water runs freely over the soil is necessary to clean sprayed veld. A light shower or drizzle must not be relied upon to clean the grazing. The alternative is, of course, to burn the sprayed patches when they are sufficiently dry.

LOCUST POISON: DIRECTIONS FOR USE.

The following directions for the use of locust poison are presented in an abbreviated and readily available form:—

Arsenite of soda powder, which is now being imported for the purpose of locust destruction, has advantages over the concentrated solution previously used, particularly in respect to the cost of transport and containers.

Owing to its fine state of division, it enters readily into solution in water. It is only necessary to throw the measured quantity into the vessel and to stir the water thoroughly.

The powder consists of arsenite of soda containing 80 per cent. of arsenious oxide. For spraying purposes against young hopps, 3½ ounces (by weight) are dissolved in a 4-gallon petrol tin of water. The strength of the solution may be slightly increased for older hoppers, *but in no case should exceed* 4½ ounces (by weight) to 4 gallons of water.

The powder is more conveniently measured than weighed, and the above quantities may be measured as follows, namely:—

(1) For young hoppers 1¾ fluid ounces (50 c.c.) (3½ tablespoonsful) to a petrol tin of water.

(2) For older hoppers, 2¼ fluid ounces (64 c.c) (4½ tablespoonsful) to a petrol tin of water.

In connection with the above, it is to be emphasised that in measuring with a tablespoon or other measure, the powder must be *level with the top and not heaped.* It should be noted that tablespoons vary in size, and measures made for the purpose should be used when possible.

Spraying.—The solution is used in the same way as the liquid locust poison, namely, sprayed lightly over and around the resting hoppers in the evenings and early morning, or at night, or sprayed lightly over the grass in front of slowly moving swarms of hoppers which are feeding during the day on the march. It is not necessary to *drench* either the hoppers or the herbage. Such a proceeding is both wasteful and dangerous to stock.

During the heat of the day hoppers frequently move rapidly in open formation and do not feed. Under these conditions effective spraying is difficult.

Sprayed locusts do not die immediately. The result should be looked for next day. Owing to the habit of the hoppers of eating their dead companions, the full effect, when only a portion of a swarm is actually sprayed or herbage is sprayed in front of a feeding swarm, may not be apparent for several days.

Sprayed locusts may continue to feed for a short time after being sprayed, but cease to feed long before death occurs. Arsenical cattle dip can be used in an emergency as a

good substitute for the official locust poison. A dip intended to be used at one part in 400 for dipping cattle should be diluted to one part of the concentrated dip in 160 parts of water for spraying young hoppers. For older hoppers the strength can be increased to one part in 128, but this strength should never be exceeded, in view of the danger of stock poisoning.

Care of Pumps.—For the best results, pumps should be kept in good repair. Particular attention should be given to the replacement of the gland packing and the packing on the plunger. Plenty of grease should be used. Spare packing can be obtained from Magistrates, Native Commissioners, etc.

Dusting.—If three to five holes are punched half an inch apart near the rim of one end of a five pound tin of arsenite of soda powder, using a *thin* nail, the powder can be dusted lightly over a swarm and thus effect its destruction. This method is not generally suitable under Southern Rhodesia conditions and should not be entrusted to natives, as it is dangerous in unskilled hands. It serves a very useful purpose, however, if the farmer or white assistant carries a tin as he moves about the farm, when swarms can be dusted in a few minutes without the necessity of sending for pumps, water, etc. A separate pamphlet on dusting is obtainable on application to the Department.

Baiting.—On cultivated lands baiting may be resorted to under favourable, dry conditions. Three or more ounces of sodium arsenite are dissolved in four gallons of water and the solution used to moisten a carrier such as bran, maize, or ground maize cobs. This bait should be spread thinly in front of marching hoppers or among resting ones.

Danger to Stock and Humans.—Arsenite of Soda has a slightly saline taste, which is apparently agreeable to grazing animals, and they will sometimes lick the powder up like salt. Obvious precautions must be taken in this connection. Stock should also not be allowed access to dusted or sprayed areas until after a washing shower of rain has fallen, or until the grass has dried and has been burned. Vessels used for poison should have a red band painted around them as a warning. Hands, etc., should be washed by pouring water over them

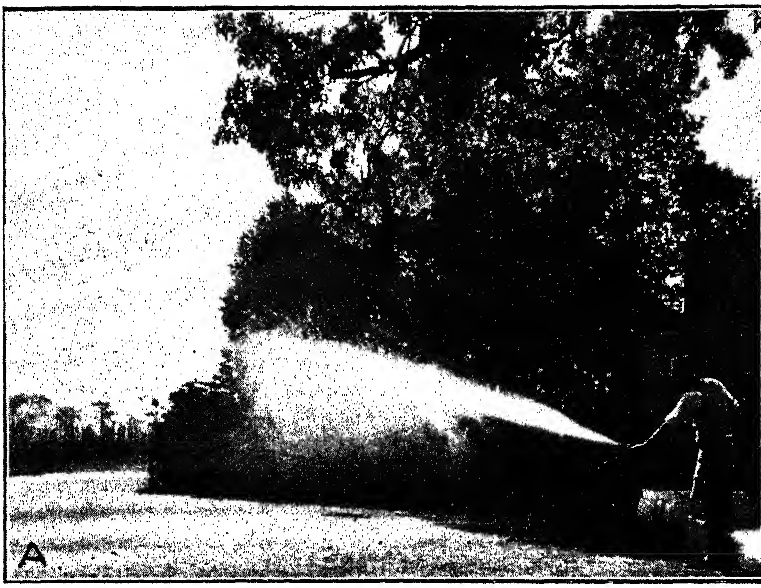
rather than by dipping them. Operators should wash hands and legs frequently to avoid caustic burning. Fat or grease should be rubbed on the arms and legs of operators. Common-sense methods should be used to avoid accidents.

ANTIDOTES FOR ARSENICAL POISONING.

The following antidotes have been advised by the Union Department of Agriculture:—

"Animals that get poisoned suffer from severe abdominal pain and purging. They should be kept in the shade and protected from cold. An ox or a horse should be given a wine bottle of a half-and-half mixture of raw linseed oil and lime water, shaken up, and then allowed to settle. Only a definite amount of lime will dissolve. This dose may be repeated in four or six hours. Castor oil or sweet oil may be substituted for raw linseed oil. A sheep or a goat should be dosed the same way, but with a quantity proportionate to its size; a dog should be made to vomit, say, with an emetic of mustard and water. Medical aid should be summoned if a person shows serious symptoms. Meanwhile, vomiting should be caused and heat applied to the stomach to relieve the distress. Oil, whites of eggs, milk, starch, gruel, etc., may be given, and also stimulants if there appears to be need. Persons who work a great deal with the poison should drink water freely, as this tends to rid the system of any arsenic that is absorbed."

The most recent publications lay emphasis on the value of emetics, purgatives and copious and repeated draughts of water. The value of direct antidotes has been called into question.



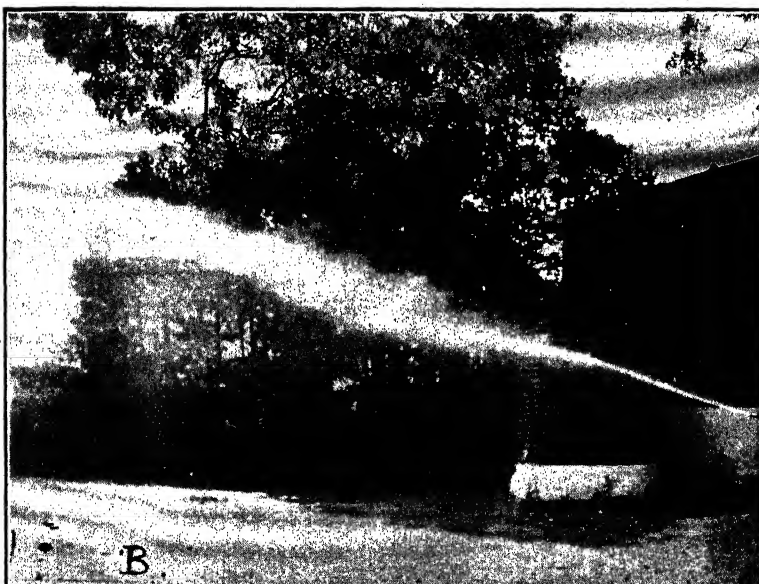


PLATE I.

Spray obtained with good pressure, using standard locust pump and nozzle. The same equipment was used for both photographs.

A. Using nozzle partly open.

B. Using nozzle fully open.

(Photos by [illegible]

PART II.

BIOLOGICAL NOTES ON THE RED LOCUST.
Nomadacris septemfasciata, Serv.

By M. C. Mossop, A.F.C., M.Sc.,
Entomoligst.

Apart from twenty to thirty swarms of the Tropical Migratory Locust (*Locusta migratoria migratorioides*, Rch. and Frm.) that flew across the country from the N.E. to the S.W. in September and October, 1932, without breeding, the present locust invasion commenced in late November when swarms of the Red Locust (*Nomadacris septemfasciata*, Serv., Plate II., A) began pouring into the Colony from the north all along the Zambesi River. These locusts had evidently been flying around in warmer or more humid parts during the dry season, but with the advent of the rains commenced a definite southerly migration. This migratory flight, however, was soon arrested, the swarms began to circle, and it became evident that the locusts were to make Southern Rhodesia the home of their offspring.

A few swarms of mature Tropical Migratory Locusts* also entered the Colony about this time.

On the arrival of the Red Locust swarms in the country the females were not yet capable of laying eggs, but the eggs were rapidly increasing in their development in the ovaries. Early in December, mating was observed to be taking place.

MATING.

General mating, with its accompanying change of locust coloration to be described later, is the first obvious outward sign of an imminent hopper outbreak somewhere in the neighbourhood. Such mating occurs early in the wet season, and by

*Known in the Union of South Africa as the European Locust. and in the North as the Hairy Chested Locust.

a large proportion of the swarm at the same period. Although mating couples have been seen on vegetation, the act of mating generally occurs on the ground. The locusts are not easily disturbed at this time, when males and females can be watched walking slowly over the ground. On approaching within about six inches of a female, a male jumps on to her in any position and having secured her, adjusts himself to the typical position so often described in text books. A male will often be seen to jump on a mating couple, but is usually dislodged forthwith. Occasionally a male can be seen to attempt mating with another male. The attempt and immediate abandonment indicates an imperfection in some sense such as sight, smell, or an insect sense as yet unknown.

The noise heard in a swarm of mating locusts of this species resembles that made by drawing a couple of nails lightly one after the other in rapid succession over tightly stretched wire gauze. It is quite distinct from that made by the mating Tropical Migratory Locust.

Pairs in a swarm may mate for several hours, and the swarm as a whole for several days. Pairs undisturbed in cages may take days.

EGGS AND EGG-LAYING.

It is not known whether eggs are laid *en masse* by large circling swarms which have just completed their migration. It would seem that these swarms in their apparently aimless wandering leave behind smaller swarms which are ready to lay. Perhaps these smaller swarms are left behind because the females are too heavily laden with eggs to go on, and males in a proportionate number remain with them. Such swarms we have termed "egg-laying swarms," and they frequently, but not always, remain in the vicinity where they were left. There is some native evidence, however, that the larger swarms have settled for a night, deposited eggs, and departed in the morning, but the hatchings from these have not been greater than those from egg-laying swarms.

Frequent reports of egg-laying at night have been received. Observations of egg-laying swarms during night time have not so far confirmed this, but some caged specimens

that were at 10 p.m. given soil in which to lay, were seen to be laying at 6 a.m., and, indeed, some had completed laying. Caged specimens have also laid during the day time.

The sites chosen for egg-laying vary. Ploughed lands, grasslands, woodlands, hillsides, and valleys appear to offer equal attraction. Sandy soils, red soils and black soils of various kinds are used, provided they are reasonably soft. Softness appears to be an attraction. A heap of loose soil piled up by an antbear in making its burrow was later found to harbour many thousands of eggs. Loose soil fallen from the sides of a deep trench was preferred to adjacent fallow land. The eggs of this species are laid in scattered patches and the possibly scattered nature of suitable sites may be partly responsible for this.

Suspected egg deposits are most easily revealed by scraping the surface of the soil away gradually with a badza (native hoe); this usually leaves a clean scraped surface in which the eggs can be readily detected.

Eggs are usually laid a few days after general mating has occurred. The female, often with a male on her back, digs a hole roughly a quarter of an inch in diameter by means of the four curved hooks at the tip of the abdomen. The abdomen stretches to a surprising length, probably being pulled rather than pushed down into the hole by the progress of the curved hooks with which she digs. The hole is more or less straight, at right angles to the surface, and about two to two and a half inches deep. Many holes are discarded before completion, presumably because an unsuitable site has been chosen. Unused holes are usually filled or covered with soil after the first succeeding rain.

From twenty to a hundred banana shaped eggs may be deposited in one hole, starting from the bottom, and forming what is known as a pod. Accompanied by a little frothy secretion, the eggs are laid in the hole, almost vertically in secretion, the eggs are laid in the hole almost vertically, overlapping or shingled from the centre outwards, quite distinct from those of the Migratory Locust. A mass of frothy white secretion is then deposited, usually to the top of the hole. This secretion hardens to a porous mass and

forms a suitable means of egress for the newly hatched insects. Where eggs are laid in soil that hardens on drying, this provision for emergence is sometimes very necessary. In spite of it, however, some egg deposits were observed, over which soil had been washed and had subsequently hardened. The newly hatched hoppers had been imprisoned by the hard crust and had died.

When newly laid, the eggs are yellow in colour, very soft, and about $\frac{1}{4}$ inch long. Usually the length of the pod is about an inch or more, and that of the froth about an inch. What appears to be the maximum overall length is $2\frac{1}{2}$ inches. Within a few hours of being deposited the eggs harden slightly and at this time it is easy to remove a whole pod intact, together with the core or froth on top of it. After several days in warm, moist soil the eggs can be seen to have swollen considerably, darkened to yellow brown or light brown, and to have lost their adhesivity, so that it is very difficult to remove a pod intact, the mass falling apart at the slightest touch.

The incubation period is generally regarded as thirty days under suitable conditions. Conditions in Southern Rhodesia in December, 1932—January, 1933, were apparently not suitable, since practically no eggs were reported to have hatched within the expected period. Continued rains and lack of sunshine brought about cool conditions which prolonged the hatching period. The maximum period recorded under natural conditions was 54 days, and some insectary rearings took longer. The normal period appeared to be about 40 days. Towards the end of this time the eyes of the developing embryo could be seen through the "shell." Successive hatchings from the same egg pod may be extended over a week.

One or two pods appears to be the number laid by a female.

HATCHING.

Hatching takes place underground, and, contrary to a widespread belief, the egg shells remain underground. The shell splits and a whitish insect crawls out. This is not the young hopper but what is termed the vermiform larva, which cannot hop but can only crawl. On hatching out, it makes

its way upwards through the white porous core above the egg pod and appears above the soil. Here it proceeds to shed its white skin almost immediately, and becomes the first stage hopper. The site of locust hatchings is marked by a litter of rolled up skins. Occasionally the rolled up skin will remain attached to the hopper's hind leg for more than a day. Under certain conditions, the vermiform larva may sometimes remain underground for a day or more before making its way to the surface.

THE HOPPERS.

On emerging from the vermiform larval skins, the young hoppers remain scattered around the hatching site for a few hours before they move off. During this time they change from their whitish yellow colour to brown, with dark brown to black markings. The heaviest joint of the hind leg (*i.e.*, the femur) is pale with dark brown to black spots, the most striking mark on the femur being a black band around it near the hind end. This black band persists through all the later hopper stages, though it is lost in the adult or winged stage.

The very young hopper of the Red Locust looks less like a locust hopper than do the young hoppers of many other locusts, which are at once recognised by the comparatively large size of the head and femora. In the Red Locust these characters are not so striking, but the black band around the femora as above described will help to distinguish it from other locusts or from young gregarious grasshoppers that are otherwise likely to be mistaken for it. The small bands of hoppers that move away from their birthplace are soon joined by similar small bands, and the process normally continues until large swarms are formed.

Like other insects locusts shed their skins at intervals as they grow. The Brown Locust (*Locustana pardalina*, Wlk.) of the Union of South Africa, and the Tropical Migratory Locust, both of which have been known to breed in Southern Rhodesia, grow through five hopper stages, and at the end of the fifth moult become adults. After each moult the developing wing pads are seen to be larger. During the past season the swarming Red Locust grew through six hopper stages in

this Colony. Whether the normal number for this locust is five or six is not known; the cool, wet weather experienced when the hoppers were in their younger stages may, by lowering their rate of development, have been responsible for an extra moult.

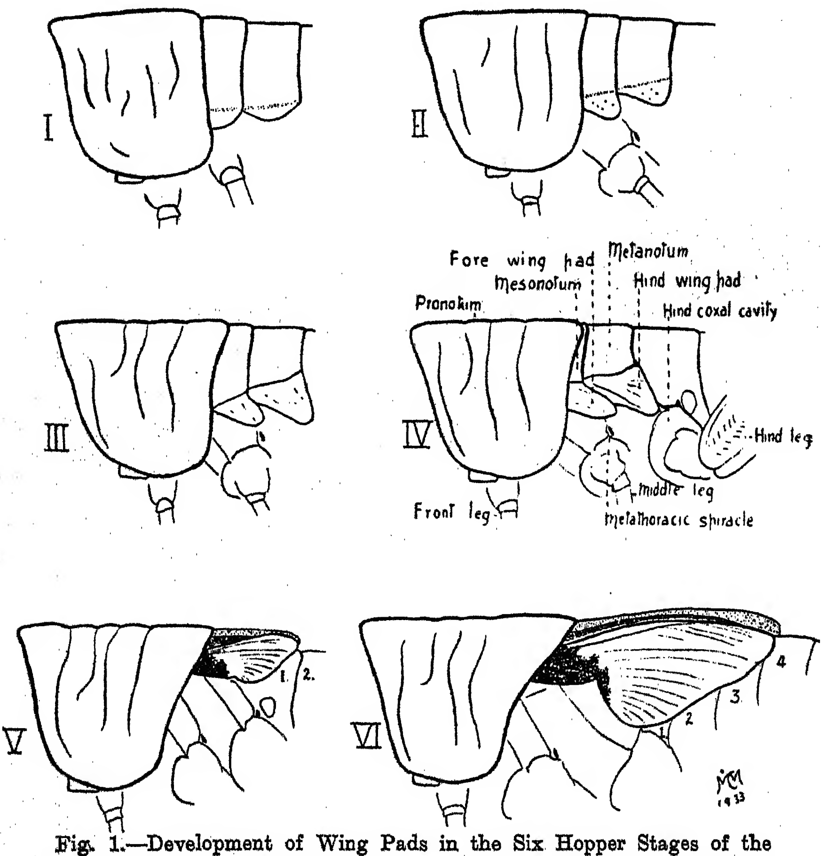


Fig. 1.—Development of Wing Pads in the Six Hopper Stages of the Red Locust. I. to VI. 1st to 6th stage; 1, 2, 3 and 4, 1st, 2nd 3rd and 4th abdominal segments.

The Hopper Stage.—The six hopper stages may be distinguished by means of the characters described below. A good hand lens will in most cases be necessary for examining the characters. Drawings showing the development of the wing pads and explaining some technical terms can be seen in Fig. 1. The mesonotum is sometimes hidden under the pronotum. In the drawing of the 4th stage hopper it is shown

almost hidden. The measurement of length is taken from the head to the tip of the abdomen.

First Stage Hopper.—Length 6-10 mm.

Antennæ (feelers) 3mm.; 13 joints.

Wing pads indistinct as small bow-shaped lobes projecting downwards from meso- and metanotum; hind wing pad not projecting backwards beyond metanotum.

Second Stage Hopper.—Length 10-17 mm.

Antennæ 3.8—4.5 mm.; apparently 17 or 18 joints.

Wing pads projecting downwards and backwards; front wing pad pointing towards metathoracic spiracle (breathing pore) but distant from it by once to twice the length of the spiracle; hind pad hardly projecting backwards beyond the metanotum; hind and lower margins of hind wing pad almost at right angles.

Third Stage Hopper.—Length 16-19 mm.

Antennæ 5-5.5 mm.; apparently 20 joints.

Front wing pad pointing towards or slightly above metathoracic spiracle, and distant from it by not more than the length of the spiracle, hind wing pad projecting backwards distinctly beyond the metanotum; hind and lower margins of hind wing pad more definitely at an acute angle.

Fourth Stage Hopper.—Length 18-28 mm.

Antennæ 6.5-8 mm.; apparently 22 joints.

Front wing pad pointing towards upper half of hind coxal cavity and reaching a point at least vertically above middle of metathoracic spiracle; hind wing pad touching or almost touching the top front edge of hind coxal cavity.

Fifth Stage Hopper.—Length 28-38 mm.

Antennæ 9-10 mm.; apparently 24 joints.

Wing pads shifted from sides to cover part of insect's back; hind wing pads reaching to end of first abdominal segment.

Sixth Stage Hopper.—Length 40-53 mm.

Antennæ 10-14 mm.; apparently 26 joints.

Wing pads reaching to fourth abdominal segment and often partly covering it.

In the second stage the hopper presents a much more handsome appearance than it does in the first. The yellow markings on the sides, the black stripe along the back, and the many dark orange parts contribute to the appearance, which increases favourably with each stage.

The complete hopper development from the time of hatching to the time of moulting into the adult or flying stage occupied from eight to eleven weeks in the high parts of the country where observations could be made. Some swarms which took 47 days to hatch from eggs were kept under intermittant observation. These took 75 days after hatching to mature, the average period for each stage being 12½ days. As far as could be ascertained, the actual period for each stage was within one or two days of the average.

Habits of Hoppers.—The Red Locust hopper, agile as it may be in appearance as compared with other locust hoppers, is in reality much less active. Faure* describes its activity in cages as 60 per cent., as compared with the Brown Locust 100 per cent. It is difficult to drive a swarm of Red Hoppers, since they prefer taking shelter to being driven. In a bare, open patch they may be driven with ease, but as soon as they reach shelter they hide and are difficult to move. In a field of very small maize plants they can be driven with comparative ease in warm weather, but where the plants are higher the size of the swarm being driven gradually diminishes until the hoppers are scattered over a considerable area. Given hotter weather, driving may prove to be less difficult. In general, the hoppers, on the approach of possible danger, prefer hiding to immediate retreat. On being approached they move round the grass stem, tree trunk, or whatever comparatively small object they are resting on, until they are, as nearly as possible, hidden. Should they be resting on a large

*Faure, J. C., "The Phases of Locusts in South Africa." Bull. Ent. Res. XXIII, 3, pp. 293-424, London, Sept., 1932.

surface such as that of a rock, they will hop away, and, unless pursued, seek shelter in whatever grass or bush is available.

The Red Hoppers apparently need shade and seem to be more of a bush or forest-loving species than the Brown Locust of the Union. They fail to survive in cages unless shade is given, and the more successful rearings were those in which undevoured grass was left as shelter. Hoppers exposed in unprotected cages and without a superabundance of food or trash under which to hide were not reared successfully. A fiield observation by Mr. Jack, in which hoppers of about the third stage came out on a large bare patch of ground under strong sun, indicated a definite need of shade, for many died owing to their inability to reach shelter.

When about to rest during the day the hoppers will seek dense foliage. Dense weeds, where these occur in patches in maize lands, can frequently be relied upon to shelter swarms that may be nearby. Natal red top grass (*Rhynchelytrum roseum*, Staph.) and wild rapoko grass (*Eleusine indica*, Gaertna) are favourites because they become very dense and are also sought by the insects as food. Upon this observation a suggested supplementary control measure in maize lands is based, that is, a few rows of dense weeds can be allowed to grow at intervals throughout the lands, and the hoppers sprayed when they have congregated on them in sufficient abundance. Rows of brushwood can be substituted and can also be placed outside the edges of the land, a clear space being left between the trap and the crop.

Very few observations on the marching of hoppers could be made during the past season. One imagines the individual hoppers in a marching swarm to be making their best efforts to move forward. Actually, however, each hopper makes a few jumps and then rests, while many of its companions hop by. The resting or waiting period is usually longer than the hopping period, so that the speed of the swarm is not the speed that a hopper, jumping uninterruptedly, would maintain, but is actually several times less.

Marching along roads and railway tracks is not usual with hoppers of this species, as it is reported to be with others. This is probably due to their love of shade. When seen on

such bare tracks in bright sunshine they have usually been hurriedly crossing rather than proceeding along it. It was not stated whether the huge hopper swarms that held up the railway trains on the Bulawayo-Victoria Falls line in February were crossing or moving along the track.

The avoidance of the use of such apparently convenient routes of travel must result in a lowering of the distance that could otherwise be covered in a given period. No accurate information on the distance covered is available. The stage of the hoppers concerned must have some influence, and information received seldom gave any indication of the stage. In one observed case a second stage hopper swarm moved 200 yards in six hours up a slight incline through low grass and scrub thinly interspersed with tall grass. Other reports suggest half a mile and even two miles for larger hoppers. It is unlikely, however, that swarms of Red hoppers, even in the larger stages, will travel much more than half a mile in one day under normal conditions, bearing in mind the nature of the country which they usually inhabit.

The direction of march appears to be governed by chance. No general trend throughout the country was noticable during the past season. In one area the swarms appeared to be travelling west while a few miles away others appeared to be going east. In both cases the hopper swarms were in the fifth and sixth stages, and they were descending on either side of the Umvukwe Range to the vleis below. The downhill factor was common to the two groups, but it is not suggested that the slope in itself was responsible. As the dry, cool season was commencing at the time it is more likely that if any attraction at all existed it was the comparatively moist or warm vleis on either side of the hills.

At night the hoppers usually avoid the ground and rest on vegetation—well up on the grass, scrub, or trees that happen to be available. Older hoppers, especially, may climb twenty feet or more above the ground, although many of their companions are satisfied with resting on short scrub below. In bush country their roosting formation is somewhat scattered, with here and there a dense patch, on scrub, grass, or tree trunk. In grassland, however, they more often form one or two large dense patches high up on the grass stems,

and if the hoppers are well grown they weigh the tops down to form an almost horizontal resting place thickly covered with the swarm. These patches are mistakable in the dusk for a smooth rock among the grass.

In general, locusts are grass feeding insects, and the Red Locust hopper is no exception to this rule. As these hoppers do not hatch until January and have practically all become fliers by April, there is usually a sufficiency of graminaceous foliage for their needs, either in the form of crops or the wild flora. The result is that reports of their attacking other crops are few and far between. A swarm, however, occasionally finds its way into a flower or vegetable garden, attacking some plants and leaving others. A typical report of such an invasion is "Fed on foliage of tomato, cabbage and turnip, disregarded lettuce, spinach, beans, leaks, onions, etc." Monkey nut plants have been reported as being severely damaged and cotton has suffered to some extent. Tobacco is usually left untouched by hoppers, and several reports state that the insects have devoured all the grass weeds on tobacco lands without injuring the crop in any way. Maize is, of course, severely attacked, and is preferred to many other grasses. When feeding on grasses the hoppers devour the leaf, leaving the midrib and some of the larger veins. Seed heads, while still succulent, are also devoured, and are sometimes taken in preference to leaves.

Feeding ceases for some time before and after moulting.

When the end of the sixth stage is reached, the final moult takes place and an adult with functional wings emerges. This act of moulting occurs in the usual way. A longitudinal split appears on the back behind the head and the insect of the new stage gradually crawls out, the hind legs being the last to leave the old skin, which frequently remains attached to the stem on which the insect has moulted. The largest number of skins, however, is found on the ground where a swarm has moulted. Being light they are carried by a faint breeze to some obstacle or shelter, where they pile up in their hundreds.

All the individuals of a swarm do not necessarily moult at the same time, a swarm sometimes taking several days. At

the time of the last moult, therefore, the swarm may consist of hoppers and fliers. The fliers usually stay with the swarm until the remainder have obtained their wings.

Experiments in Controlling Hoppers by Chemical Means.—Owing to the exigencies of the campaign against hoppers during the past season, there was insufficient opportunity to carry out many tests against them. The tests that could be carried out by the writer were distributed among three different localities and during three different periods. Forty field swarms were experimented on and a further series of experiments was conducted by a locust officer in the field. The main objects were, first to discover whether soap solutions could be used to combat hoppers, especially with a view to controlling them in maize lands, and secondly, to discover whether baiting would constitute an effective control.

The results were inconclusive and in some cases contradictory, but in the light of experience gained, further tests should be made.

Soap solution, to be effective, must be sprayed on to the hoppers heavily enough to drench them. (This is an operation that may well be performed by natives, if one may judge by the heavy way in which they apply the arsenical locust spray, although instructed to spray *lightly*.) One series of experiments suggested that one pound of soap dissolved in three gallons of water and applied at blood heat kills hoppers of the first and second stages if the vegetation is such that the hoppers can be drenched. Here the habit of moving round to the far side of their perch when disturbed stands the hoppers in good stead. A weaker soap solution sprayed on hoppers in dense grass failed to kill more than 40-50 per cent. In experiments with larger hoppers in maize lands soap solution at the strength of one lb. in two gallons of water seemed to daze them for a few hours, after which they recovered. In a number of tests, soap solutions sprayed on maize plants under varying conditions failed to injure the plants, but it should be emphasised that such strong soap solutions may possibly injure maize under certain weather conditions.

Experiments with poison baits for the control of hoppers in maize lands indicate that baiting, also, is limited by local

conditions. The chief attraction of the bait appears to be the moisture it contains. The bait must therefore contain more moisture than the maize and be wetter than soil. It was concluded that wet soil was the chief factor in the failure of one series of these experiments. The most successful test of the damp soil series, however, was one in which ground maize cobs saturated with the poison solution were used. Ground-up maize cobs consist of small porous pellets mixed with a dust. This substance can be saturated with water and yet be spread evenly over the soil. Similar saturation of bran or maize meal makes it difficult to spread these baits without their falling in dangerous lumps. Further, on being soaked, ground maize cob increases in volume.

Under dry conditions later in the season, and with larger hoppers, baiting gave more promising results. It is expected that further tests will be carried out with young hoppers in maize lands during the coming season. The tests will be commenced by using ground maize cob, 4 gallons, water 2½-3 gallons, and sodium arsenite not less than 3 ozs. Should any farmer test this bait on his lands and communicate his results, whether good or bad, together with a report of weather and soil conditions, etc., to the Department, the information will be appreciated. Maize cobs should be conserved and kept dry for the purpose.

ADULTS.

The newly moulted swarm adult presents a striking and handsome appearance, and differs markedly from the hopper. In general appearance it is reddish brown with a whitish stripe down the back, including part of the folded wings. A similar stripe runs along each side. The front wings are marked with a number of large brown spots or blotches and extend beyond the abdomen. The hind wings are clear and colourless. After the adult stage is reached no further moulting takes place, but changes in colour occur.

Two or three months later the colours have reddened and the stripe on the back and sides have almost disappeared. At this time the hind wings begin to take on a pinkish appearance

at the base, particularly on the veins. The first sign of this pink coloration appears on the axillary membrane, which is a small enclosed membrane at the base of the wing.

After two or three months more the adults are definitely red, varying from dark red to crimson. The brown abdomen, being hidden by the wings, does not detract from the red or crimson appearance. The hind wings are now crimson at the base, including the axillary membrane, and the basal portion of the fore wings is also tinged with crimson.

With the coming of the rains after yet another two or three months, the typical mating coloration appears. A yellowish tinge is assumed, the males becoming quite yellow. At this time mating and egg-laying take place, and males can be distinguished by their yellow colour from females.

The sexes can be distinguished at any time by examining the tip of the abdomen. In the male the lower part of the tip is comparatively soft, projects beyond the rest of the abdomen and tapers with an upward curve almost to a point. Each side of the abdomen near the tip bears a short soft clasper. The end of the female abdomen is fitted with four hard, pointed hooks. When closed, as they usually are, they appear as two small points, the lower hooks being hidden between the two upper ones, but the four hooks can easily be separated with a pin. During the mating and egg-laying season the top pair of hooks is widely separated from the bottom pair.

Habits of Adults.—As all the individuals constituting a hopper swarm do not moult at the same time, the moult from hoppers to adults brings about a mixed swarm, the proportion of adults increasing as moulting progresses. The adults remain with the hoppers, and continue to behave largely as hoppers, but take occasional short individual flights in the neighbourhood of the swarm.

When a swarm eventually consist of adults only, that is, after several days, it does not immediately leave the neighbourhood, but makes short, "circling" flights within the neighbourhood for about ten days. During this time it may be joined by similar swarms that have developed nearby.

Gradually, the combined swarms fly further from their place of origin until they have definitely departed, and may fly several miles a day.

At this time the locusts are voracious and do not confine their attention by any means to grass crops. The amount of feeding thereafter diminishes, the foliage that is devoured being apparently taken chiefly for the sake of its moisture, the dry season having now set in. Tobacco, which is normally ignored by hoppers, may now be severely damaged, attention being almost entirely confined to the midribs and some of the larger veins in the search for moisture.

The following are some examples of plants attacked by Red Locust adults in the dry season:—Foliage of grasses including bamboo, banana, palms of several kinds, tobacco, various garden shrubs, etc., beefwood trees (*Casuarina Cunninghamiana*), Eucalpytus, citrus, msasa (*Brachystegia randii*), oleander, various fruit trees, and the new bark and buds of decidious fruit trees. The list is far from complete. Frequently the locusts will strip one kind of tree and leave another untouched. Examples are:—Beefwood prefered to Eucalyptus, *Eucalyptus citriodora* preferred to *E. saligna*, smooth skin lemon tree preferred to orange tree, oleander preferred to mixed garden shrubs and other garden plants, fruit buds of plum preferred to bark, young winter cereal preferred to half-grown winter cereal. The preferences are not, however, rigidly fixed.

Irrigated winter crops in general have suffered to a surprisingly small degree, although many individual crops, as may be expected, have been demolished. Frequently where crops have been attacked while young they have been able to recover. The saving of the crop, usually, has been due to the activity of the owner in driving the marauders away. In some instances, however, locusts have flown low over crops, and even settled among them or in the immediate vicinity, and have done no damage.

Swarms prefer forest for roosting at night, their roosting habits being rather similar to those of the large hoppers when in a similar environment. The main differences are that the

adults approach the trees by flight, and the periphery of the tree becomes more thickly covered. Branches are often broken by the weight of roosting locusts.

The direction taken by flying locust swarms is to some extent governed by the direction and strength of local winds, and these in turn may be governed by geographical features such as hills and mountains. On a calm day it is difficult to arrive at any conclusion why swarms fly in any given direction; under these circumstances, however, direction is not always fixed, and a swarm, or a part of it, sometimes reappears in the same locality. When a light wind is blowing the swarm usually assumes more or less the direction towards which it is blowing, but not its speed. The flight of a non-migrating swarm, may be compared to the marching of a hopper swarm, that is, while many are progressing, large numbers are resting or feeding, so that the rate of progress of the swarm becomes several times less than that of the speed of a flying locust. In addition, the direction of flight assumed after resting is usually not that of the main swarm's progress. On taking the air after a rest or feed the individuals direct their flight more or less in the opposite direction to that of the swarm. This direction, or attempted direction, is maintained until the main swarm above is reached, when it is deliberately changed to that of the swarm.

A swarm may usually be seen attempting to fly to some extent across the wind, but the wind, unless it is very light, carries the swarm with it, so that its direction is almost that of the wind itself. Such a swarm was observed in Salisbury, and when the wind dropped in the evening the swarm continued in its apparently intended direction, practically at right angles to that in which it had been blown. The writer has not observed locusts flying directly with or directly against the wind.

The migrating swarms of the Tropical Migratory Locust that flew through the country a year ago travelled at a maximum recorded rate of 33 miles in a straight line in one day. They were travelling approximately with the wind, which was blowing S.W. The progress of several of the earlier swarms could be traced from day to day for about a

week. On one day the wind changed to N.W. and locust reports showed the swarms to be going in that general direction. The following day the wind resumed its normal south-westerly direction, and the swarms again followed it. The height at which the swarms were flying is not known, and therefore the velocity of the wind carrying them cannot be ascertained, but it was more than that of a gentle breeze.

The distance of a day's flight of the Red Locust has not been ascertained during the present invasion. Reports, however, indicate that ten to twenty miles is not unusual, the swarms all flying low. The behaviour of swarms after they have commenced their definite migratory flight may be entirely different, but the information on this point is not available.

During the colder weather, which in this Colony is part of the dry season, the flying swarms appear to keep to some extent to the parts of the country that are low. In warmer periods during this season they showed themselves in higher country, but usually made their departure before long. In the lower parts, and also in higher parts that are moist, (*e.g.*, the misty mountains of the Eastern Border) swarms may remain in a locality for several weeks. Moreover, the larger swarms are reported from such areas, and it is probable that the common attraction of these areas is largely responsible for the combining of swarms. It is expected that as the weather becomes warmer the swarms will make longer excursions over the country until, with the coming of the rains, a definite migration (probably generally south) will take place. This will not rid the country of locusts, as more are expected to enter the Colony from the north, when mating and egg-laying, as already described, are expected to occur and once again begin an annual cycle.

LIFE HISTORY OF THE RED LOCUST IN SOUTHERN RHODESIA, 1932-33.

Migratory flight ended December.

Mating occurred and eggs laid December and January.

Adults died January and February.

Eggs hatched January and February.

Six hopper stages of about 10 to 14 days each, January to April.

Number of generations per year, one.

The number of generations in a year is a subject that has been much discussed with reference to this locust. Of recent years, however, doubt has been dispelled, and experiences in this country and elsewhere confirm the opinion that, unlike the Brown and the Tropical Migratory Locusts, the Red Locust has but one generation a year, about nine months being spent in the adult stage.

HOW TO DISTINGUISH THE RED FROM THE TROPICAL MIGRATORY LOCUST.

Red Locust.	Tropical Migratory Locust.
Eggs.—Almost vertical in pod; overlapping or shingled from the centre outwards.	Laid in rows or layers in pod; not shingled from the centre outwards.
Pod without outer coating of froth.	Pod with outer coating of froth.
Hoppers.—Black band near end of hind femur.	No black band on hind femur.
Top of prothorax not *velvety* black.	Top of prothorax *velvety* black.
Adults.—Front wing blotched rather than spotted (see Plate II., B).	Front wing spotted, not blotched. (See Plate II., C.)
(Hind wing of older specimens crimson at base.)	(Hind wing of all specimens colourless.)
Strong spine between front legs.	No spine between front legs.

NATURAL ENEMIES.

In the present invasion no remarkable measure of control of locusts by natural enemies has yet been attained. The commonest enemy during the incubation period was a predacious fly, *Stomatorrhina lunata*, F. The maggots of this fly remove the contents of the eggs, leaving only the shells. If

a locust egg pod is dug up carefully when the maggots are nearing their full size, a seething mass of maggots is seen among almost empty egg shells. On becoming fully fed, most of the maggots crawl an inch or two away under the soil and pupate; a few may pupate among the empty egg shells. Ten to fifteen days after pupation the adult fly emerges and makes its way to the surface of the soil. The adult flies have been observed feeding on the flowers of the family Compositæ, such as daisies, thistles, blackjack, etc.

In one maize land, up to 95 per cent. of locust eggs examined had been destroyed. A few other reports of good control exercised by the fly was patchy and negligible.*

Other enemies of the eggs were mites, which in one case observed occurred in thousands, destroying eggs in a very limited area; and also certain beetle grubs which failed to mature in the laboratory and whose identity is unkown. Some eelworms were observed attacking eggs, but their attack may have been of a secondary nature. Wasp-like parasites were seen in one locality, but in very small numbers, and an attempt to rear adults failed.

A parasite that may prove of benefifit is a threadworm which can be found in the hoppers and adults. As many as ten of these were found in the abdomen of an adult locust. The worms may be up to several inches long. They were also found in hoppers of the fourth, fifth and sixth stages. So far, during the present invasion, threadworms have been found only in locusts from Lomagundi District, but in view of the wanderings of flying swarms it is hoped that the parasite will appear more extensively in the future.

The conspicuous red mites that were seen on the wings and bodies of adult locusts are not considered to be of great

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*Mr. A. Cuthbertson observed this fly (*S. lunata*) to be widely distributed and abundant at Balla-Balla in the early wet season, 1933. He adds the following notes:—

Both sexes feed on the nectar of flowers of *Gymnosporia* sp. (Compositæ). The fly is probably not a specific predator, in the larval stage, of swarm locusts, as female flies have been observed laying eggs in soft soil at the edges of cowdung heaps infested with termites. The newly hatched larvæ actively burrow downwards into the ground where they presumably attack the larvæ and pupæ of dung-breeding beetles and flies. Larvæ are predacious.

importance. Other enemies or diseases such as certain flies, the much discussed locust fungus, and bacteria were not evident.

Frequently flies are found breeding in dead locusts and are mistaken for parasites. The two commonest of these during the past season were a Sarcophagid (grey-bottle) and *Muscina stabulans* Fln., both of which species are sometimes incorrectly recorded as parasites in cases where they have been acting as mere scavengers of dead insects.

THE THEORY OF LOCUST PHASES.

The theory of locust phases is gradually becoming generally known by the public. It has been mentioned in previous numbers of this *Journal* and explained in the daily Press. Briefly, it states that locusts have two main phases, *solitaria* and *gregaria*. *Solitaria* lives as an individual or solitary grasshopper and *gregaria* appears in swarms. The disturbance and resultant increased activity that obtains when many hoppers are in close contact indirectly favours certain types of coloration and form of body by which the phases may be recognised. Similarly there are differences in the resulting adults. *Solitaria* may change to *gregaria* or *vice versa* in one generation under artificial conditions. Intermediate forms occur also. There are certain areas, known as permanent breeding grounds, which are permanent habitats of the species of locust concerned. In these areas *solitaria* can breed up through the intermediate forms until large swarms of *gregaria* are formed. These in turn may migrate, breeding more *gregaria* forms intermittently as they progress. After the successive swarms have devasted large areas, the cycle eventually dies out.

The *solitaria* phase, however, can continue to exist in certain favourable areas, apparently without ever increasing to such an extent that swarms are formed. For instance, a few solitary Red Locust adults were collected by Mr. Jack on the Eastern Border in 1915, the last known swarm south of the Zambesi having disappeared in 1910. Little is yet known of the form and coloration of the phase *solitaria* of the Red Locust.

An area in the extreme north-western corner of Northern Rhodesia is now suspected of being a permanent breeding ground of the Red Locust. It is obvious that a knowledge of the permanent breeding grounds is of extreme importance in any attempt to prevent the occurrence of swarm cycles.

Faure (*loc. sit.*) has recently evolved a theory to account for the different coloration of *gregaria* and *solitaria*. This he calls "The Theory of Locustine Production." He proposes the word "locustine" for the products of excessive metabolism which lead to the development of the *gregaria* coloration. He also states: "The process of locustine production does not cease at the end of the hopper stages, but continues during the flight activities of the adults." His theory is based partly on, and explains, the persistant black coloration of the hoppers of certain locust species. He argues that as the result of the excessively high rate of metabolism obtaining in swarm life a surfeit of excretory products is produced, and these or their derivatives are deposited in the cuticula.

Certain observations made in Southern Rhodesia may be explained by this theory. As previously stated, the young Red adult is reddish-brown, striped, and has colourless hind wings, but after flying about for a few months it becomes red to crimson, practically loses its stripes (which also redden), and develops a pink or crimson colour at the base of the hind wings, including the axillary membrane. But a locust kept, from the time of attaining its wings, in a cage where it is not subject to the activity experienced in swarm life, does not develop the red coloration on the body, does not lose the stripes, and develops a *purplish* colour on the base of the hind wings, the axillary membrane remaining colourless. This would suggest that the development of the red coloration of at least the body and axillary membrane is due to locustine. The pink or crimson colour at the base of the hind wing of swarm specimens may also be due to locustine, but the theory of locustine production does not seem to account for the purplish colour similarly situated on the hind wing of caged specimens.

Bearing in mind the above theory, it would seem that the caged specimens described exhibit a coloration approaching that of the phase *solitaria*, or an intermediate phase. If the

observation is correct, two specimens collected in the Melsetter District on 24th June, 1933, constitute further slight evidence that the Red Locust can make a permanent home in the phase *solitaria* on our Eastern Border. These two specimens presented an appearance similar to caged specimens described above: the purplish colour on the hind wing was very strongly developed and the axillary membrane perfectly clear and colourless; the colour was a deep brown with the usual whitish stripes. At the same time two other specimens were sent that exhibited the coloration expected in younger swarms at that period, namely, with the red of the body beginning to develop, the stripes disappearing, a cloudiness in the axillary membrane, and the basal part of the hind wings colourless. The latter two specimens were considered to have been left behind by a swarm.

The four specimens were all females and were collected on the same day and in the same locality, at least three weeks after the previous swarm had gone by. It should be noted that at this time the development of coloration in the hind wing in the new generation had only just commenced. The first mentioned specimens, if one may judge by the development of colour in the hind wings, must have been considerably older than those in swarms then flying about the country, and if so must have hatched from eggs laid before the invasion of the Red swarms into this part of Africa. Average monthly rainfall records show that at certain places on the Eastern Border there is a greater precipitation in the months immediately prior to the onset of the general rains than occurs in the interior, and eggs may therefore have been laid by solitary locusts and hatched before the advent of the swarms.

Coupled with the discovery in 1915 by Mr. Jack of a few solitary-living Red Locusts on the Eastern Border, already referred to, the above suggests that the two specimens under discussion are of the phase *solitaria*, hatched from eggs laid earlier in the season than those laid by invading swarms, and

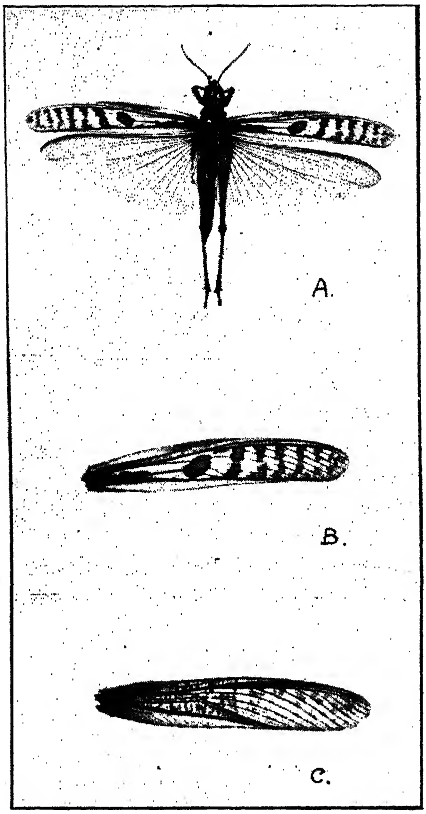

PLATE II.

A. Red Locust flier (reduced).

B. Right front wing of Red Locust (reduced).

C. Right front wing of Tropical Migratory Locust (reduced).

(Photos by M. C. Mossop.

that they are the progeny of a line of solitary phase Red Locusts that had existed on the Eastern Border since at least 1909. When more is known of the conformation and measurements of the solitary phase of Red Locusts, further evidence may be obtained.* The change of colour in *gregaria* adults caged when young makes it evident that colour characters are not sufficient for the recognition of the phase *solitaria*. It is further possible that parasites and diseases of adult locusts, by lowering their vitality and consequent activity, may bring about the colour markings (but not conformation) of *solitaria* in *gregaria* specimens. Now that the country is overrun by the Red Locust, it will be some years before proof that the Eastern Border is a permanent habitat of the solitary phase of the Red Locust can be forthcoming, unless convincing specimens can be found in private or other collections. Be this as it may, however, there is no evidence that a swarm cycle ever had its origin in any part of Southern Rhodesia.

*The Red Locust adults of the present invasion are considerably smaller than descriptions of the typical Red Locust indicate. The two suspected *solitaria* specimens from Melsetter were larger than our swarm specimens, whereas the other two were of the same size and proportions. The front wing of the suspected *solitaria* specimens was shorter in relation to the body than that of our swarm specimens, and the hind femur was more than half the length of the front wing, whereas in our swarm specimens it is appreciably less than half.

Mycological Notes.

WHYS AND WHEREFORES OF SPRAYING.

By J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A.,
Government Plant Pathologist.

At this time of year one hears a good deal about spraying, particularly in relation to tobacco seed beds. In fact, with the exception of locusts, the general opinion appears to be that tobacco seed beds are the only things upon the farm which can be sprayed. Then spraying is spoken of in an abstract kind of way—"Oh, yes, I always spray my beds once a week"—(or fortnight, or season as the case may be), as much as to say, "Well, I suppose we *have* to do these things, but I have a nasty feeling that my leg is being pulled." Then again one often hears the question, "Do you candidly think spraying is worth while?" At one time I used to think that this was a straight forward query as to the efficacy of the scientific application of fungicides to certain crops. But now I know better. "Do you candidly think spraying is worth while?" is an idiomatic phrase with several words understood. (You remember the kind of thing with which you used to struggle in your English grammar prep.) What is really understood by the question is, "Do you candidly think that squirting tobacco seed beds with a concoction containing bluestone, by means of any old pump with a perished hose, worn out washers and ungreased packing, and a nozzle designed for cleaning cars, is going to give me an entirely disease-free tobacco crop which will have all the qualities required by the buyers?" The answer under these circumstances is, most emphatically "NO!"

Spraying, to be effective, must be carried out with the same care and attention as is devoted to the curing and grading of tobacco, seed selection of maize, picking and packing of fruit and, in fact, any operation on the farm which

determines the *quality* of the final product; for the whole object of spraying against plant diseases is to eliminate one of the most important causes of deterioration in quality—as well as quantity. Spraying is not just the application of a liquid to a plant, but a process involving highly scientific, physical, chemical and biological principles about which many large volumes have been written. No one universal fungicide is known, and what may be efficacious in destroying one group of organisms is not necessarily effective against a second group. Thus Bordeaux Mixture will, under our conditions, eliminate Ripe Rot from an apple crop, but has little or no effect upon Mildew, whereas lime-sulphur, or sulphur dust, whilst controlling the latter has little effect upon the former. Again, the strength at which a spray solution is used is a most important factor, for an excessive concentration of the fungicide may have a disastrous effect upon the health of the crop, while too little will give disappointing results—rather like whisky and soda. It is necessary therefore that manufacturers' instructions be faithfully followed. The practice of giving a double dose "to make sure" may cause a severe burning of foliage or fruit, and an attempt to lower expenses by withholding "just a little" of the fungicide may render the spraying operations useless, and is false economy. If a doctor prescribes one tablespoonful of a medicine to be taken every night, there are few people who would risk taking one teaspoonful only. Why then, if instructions are given for using, say, Bordeaux Mixture at a strength of 4 lbs. of bluestone and 6 lbs. of slaked lime to 50 gallons of water, should it be deemed expedient to use a half or two-thirds of the quantity stated? There is, unfortunately, an attitude of mind amongst a certain class of farmer which regards Bordeaux Mixture in much the same light as whitewash. If a tennis court is to be marked out, then a few handfuls of lime are thrown into a petrol tin, water added and the job is complete. The rest may be left to the boy, who, as a rule can make a first-class job of marking the court. When, however, tobacco seed beds, the tomato or potato crop, or the fruit trees are to be sprayed, there are many matters which need attention during the whole operation. The tobacco seed-bed season has commenced and spraying will be started before long, so make a note of these points:—

1. **Pumps.**—Make sure your pumps are in correct working order. They are easily dismantled and worn washers, packing or valve balls replaced for a few pence. Make sure that your dealer stocks spare parts, otherwise try another dealer. Hose pipe rarely lasts more than two seasons, so get a fresh supply early, and get pieces which are long enough for convenient handling, say, 8 or 10 ft.—it only costs about a "tickey" a foot. Buy proper screw-clips for securing the hose to the pump and nozzle (they cost about 2d. each) for it is difficult to make a pressure-tight joint with wire binding. Remember that a high pressure is essential for efficient fungicidal spraying, but it cannot be maintained if joints are leaky.

Now for the nozzle. It must be stated clearly and emphatically that the adjustable-tap type used on locust pumps is entirely unsuited to fungicial spraying under local conditions. In the first place, the protection afforded by Bordeaux Mixture depends upon obtaining an even film of the fungicide over the whole of the foliage. This can only be secured by using a nozzle which produces a very fine mist. Such nozzles are obtainable locally and should be purchased with a 2 foot brass-tube extention, so that an even application of the spray may be made over the whole seed bed. This extension is absolutely essential for spraying small trees and should be used in conjunction with an angle bend so that the spray may be directed horizontally or downwards. Larger trees call for the employment of 4 ft. or 6 ft. tubular extensions, which are quite inexpensive. The possession of a set of angle bends, extensions and varying sized nozzles facilitates many jobs upon the farm. Lime-washing of grading sheds, poultry runs, or cow byres can be done by one boy in a very short space of time and much more efficiently than by a number of boys using brushes—or what pass for brushes. A whole outfit comprising pump, 10 ft. length of hose, a strainer, several nozzles, extensions and angle pieces, suitable for spraying the home orchard, the vegetable and flower garden, tobacco in seed beds and lands with both insecticides and fungicides, and also for whitewashing (or cleaning the car, if necessary!) may be purchased locally for about £1 10s. 0d. or less. Such outfits, if carefully tended and worn parts replaced, will last for

years, but they must be thoroughly cleaned immediately after use, each time, and the washers and packing kept well greased and a tight fit.

Now the adjustable-tap nozzle is quite suitable for throwing a coarse spray or jet some thirty or forty feet as is required for locust work, but, even when carefully adjusted to a very small aperture, a mist-like spray is difficult to obtain without the expenditure of an enormous amount of exertion in pumping. Where native labour is concerned, any operation which necessitates continued hard, physical effort is unlikely to be successful, and when the amount of work involved by pumping can be substantially reduced by a slight turn of a tap, the fact that this produces an unsuitable spray is unlikely to cause any acute mental suffering to the operator. Such slipshod spraying is common all over the Colony. There is only one remedy, namely, the employment of suitable up-to-date pumps.

So much for pumps. Water cans do not warrant space in this article, they are wasteful and useless for Bordeaux Mixture.

2. **The Spray Fluid.**—As spraying may be regarded as a low premium form of insurance for the crops, it is obviously a short-sighted policy to use anything but the best materials. If home-made Bordeaux Mixture is used, then the best high-grade stone lime must be obtained and slaked with water in the correct way. Agricultural lime and air-slaked lime must never be employed. Best quality bluestone must also be used and the fungicide prepared in a recognised manner; the way in which the ingredients are mixed being of vital importance. Full instructions are contained in the Departmental handbook "Tobacco Diseases in Southern Rhodesia," obtainable from the Herald Store, Salisbury, price 4s. 4d. postage paid. If a proprietary brand of Bordeaux Mixture is preferred, then the best quality only should be used and the maker's instructions followed in every detail. A few shilings saved by the use of inferior material may entirely nullify the benefits to be obtained from spraying.

3. **Containers.**—It is generally stated that Bordeaux Mixture must not be made up in iron containers; wooden barrels, as a rule, being recommended. Wooden barrels are not entirely suited to the Colony with its long dry season to cause shrinkage, and its "white ants" to cause even greater shrinkage! Ninety gallon wooden barrels, which can be purchased for 10s. each, have been used by this Department with success, but iron drums are superior in convenience and longevity provided an inert coating of some kind be given to the inside to protect the Bordeaux Mixture.

Tests are being carried out with several substances which appear to offer a way of overcoming the difficulty. Graphite paint has been recommended by a firm of copper fungicide manufacturers in England and is included in the tests. It has proved quite satisfactory. In any case, the spray solution should be made up in bulk, say 50 gallons at a time, and ladled out in small containers for the actual spraying of seed beds. Measuring out small quantities at a time of powder and stirring up with water in petrol tins is a method likely to produce an irregular product, with the attendant results of under or over dilution.

Lime-sulphur may be made up in iron containers, and the concentrated product, being in liquid form, does not offer the same difficulties of manipulation as Bordeaux Mixture.

For orchard spraying, the simplest method is to mount a sufficiently large container on a scotch cart and allow enough hose piping for the operator to move freely round the trees. Large trees and extensive orchards, of course, need a more powerful outfit than is usually employed for gardens and tobacco seed beds, but most spraying operations can be performed in a satisfactory manner with moderate sized equipment, such as described earlier in this article. These words are addressed to the large section of mixed farmers and tobacco growers, and do not apply to the commercial orchardist who cannot hope to make a success of fruit growing unless he is prepared to lay out a certain amount of capital on high pressure spray equipment and adopt a generous and regular spray schedule.

In conclusion, do not be under the misapprehension that just "spraying" your fruit trees, roses, tobacco, potatoes, etc., will cure your troubles. In the case of nearly all fungoid and bacterial diseases it is necessary to spray before the disease develops to any extent (but preferably while the plants are still healthy), to use the correct spray fluid at the correct concentration, to apply a mist-like spray under high pressure by using a good pump and suitable nozzle, to make applications at correct intervals of time, and to supplement spraying with thorough cleaning up and destruction of infected material. These precautions are practically the same as those adopted in a sick room which has harboured infectious diseases; the only difference being that on the farm you do your own spraying, but you pay for the sick room to be done.

The Locust Invasion of Southern Rhodesia, 1932-33.

By R. W. Jack, Chief Entomologist.

The following article deals mainly with the organisation and conduct of the campaign waged against the hopper outbreak following the invasion of the Colony by swarms of winged locust during November and December of 1932. It is intended to inform the agricultural community of the Colony concerning the results of the campaign, the present position and the prospects for next season. It does not deal in detail with the technique of control measures or with biological observations, concerning which it is intended to publish a separate bulletin.

General.—Africa is afflicted with five different species of swarm locusts, namely, (1) The Moroccan Locust (*Dociostaurus maroccanus*, Thnb), (2) The Desert Locust (*Schistocerca gregaria*, Forsk), (3) The Tropical Migratory Locust (*Locusta migratoria migratorioides*, Rch. & Frm.), (4) The Red Locust (*Nomadacris septemfasciata*, Serv.), and (5) The Brown Locust (*Locustana pardalina*, Wlk.). Of these only the three last named species are known in the swarm phase in Southern Africa and all three species have invaded Southern Rhodesia from time to time.

The position is that whilst Southern Rhodesia is not known to afford a permanent home to any species of swarm locust it lies definitely within the overflow zone of both the Brown Locust and the Red Locust. The position of the Colony with respect to the Tropical Migratory Locust is less clear. Owing to the possibility of confusion with other species in the past, especially the Brown Locust, it is not at present possible to say whether this species is a very occasional or comparatively frequent visitor. The first definite record of its appearance south of the Zambesi referred to the year 1923, but there is a suggestion in a publication by the Department of

Agriculture, Southern Rhodesia, in 1906* that a third species had crossed the Zambesi from the north "of recent years," leading to a mixture in certain districts of Brown and Red Locusts with the new species. Unfortunately at that time the Colony possessed no entomologists, but it seems quite probable that the species referred to was the Tropical Migratory Locust.

From the year 1893 Southern Africa suffered severely from locusts, including certainly both the Brown and Red species, and when the Entomological Branch was established at Salisbury in 1909 swarms of both species were present in the Colony. By this time, however, the swarm cycle was waning rapidly and no swarms were recorded after 1910.

Southern Rhodesia suffered no further invasion by any species until 1922. During May and June of that year swarms of the Brown Locust crossed the western border and penetrated as far into the Colony as the Mzingwane and Matobo districts. These swarms apparently left the Colony without laying eggs. There were also two reports of locusts in Gwanda and Matobo districts in May and June, 1923. In September, 1923, certain eastern districts were "raided" by the Tropical Migratory Locust which penetrated as far west as the Hartley district. These swarms returned to Portuguese East Africa without breeding.

In the wet season of 1923-24 the breeding grounds of the Brown Locust in Northern Bechuanaland slightly overlapped the western border of Southern Rhodesia, and during the following winter a heavy invasion by winged swarms of this species occurred, eggs were deposited over a large portion of the Colony during the winter, and the hoppers appeared shortly after the first rains. A campaign was waged against these hoppers, which lasted to the end of the year, when the swarms which survived the campaign obtained wings and flew back to Bechuanaland. Disease and parasites were, however, at work and Northern Bechuanaland that year apparently experienced an unusually wet season. The swarms were vastly reduced in numbers and fliers of the next generation were

*Locust Destruction, by E. R. Sawer, Asst. to Sec. for Agric., Capetown, 1906.

reported flying southward into a drier climate. No further definite invasion of Southern Rhodesia occurred, but an odd swarm or two of fliers were reported from the S.W. districts in May and July, 1925.

In April, 1925, a large swarm of flying locusts was reported on the Makoni-Inyanga border, but specimens were not secured and nothing further was heard of this swarm. Presuming these were true swarm locusts, the species is not known.

A few swarms were also reported in May, 1926, in the Victoria and Chilimanzi districts, but no specimens were secured and the species was not identified.

No further reports of locusts were received until 1930. During that year a swarm cycle of the Red Locust manifested itself in Northern Rhodesia and at least one swarm flew over the Victoria Falls in December.

During 1931, although both the Red and Tropical Migratory species were present in Northern Rhodesia, no swarms were reported in this Colony.

From May to July, 1932, occasional swarms of fliers were observed in the extreme N.W. corner of the Colony, crossing from Northern Rhodesia into Northern Bechuanaland. The species was not ascertained.

In September, 1932, a number of large swarms of the Tropical Migratory Locust appeared from the N.E. and flew completely across the Colony into Bechuanaland without, as far as is known, laying eggs. Before the end of October the greater part of the Colony was again free from locusts, although a few swarms seem to have lingered on to November towards the western border, and a swarm of the Red Locust was reported at Matetsi in the Wankie district on November 29th.

The respite was shortlived. December witnessed an invasion by the Tropical Migratory Locust from the north which affected chiefly the north-eastern districts, whilst the Red Locust poured over the Zambesi and the western border

in large fast travelling swarms which, holding a S.E. direction, soon involved practically the whole of the Colony, including the N.E. districts, which thus suffered an invasion by both species.

Swarms of both species quickly commenced to circle and to lay eggs.

Eggs of the Tropical Migratory Locust commenced to hatch in the Zambesi Valley, in the Darwin district, on December 15th.

The first hatchings of Red Locust eggs were recorded in the Shangani Native Reserve exactly a month later, namely, January 15th, 1933.

Eggs of both species hatched freely throughout the Colony, which was quickly confronted with a widespread outbreak of hoppers of phenomenal magnitude.

Organisation.—The Chief Entomologist acts as Chief Locust Officer and is responsible for the organisation and conduct of anti-locust campaigns. The territorial unit of the organisation is the native district.

Operations in each district are under the control of a District Controller of Locust Operations (D.C.L.O.), who is in general the Magistrate.

The districts surrounding the two largest towns, namely, Salisbury and Bulawayo, constitute exceptions, as the Magistrate in such districts is not in a suitable position to control operations. In the Bulawayo district the District Superintendent of Police acts as D.C.L.O., whilst the Salisbury district is directly controlled by the Entomological Branch in collaboration with the Native Commissioners at Goromonzi and both the Native Commissioner and District Superintendent of Police in Salisbury.

In most districts the office of Assistant Magistrate and Native Commissioner is combined in one officer, who then deals with the whole district, being assisted where such officers are available, by the Assistant Native Commissioners in charge of sub-districts.

Where the office of Magistrate and Native Commissioner are separate a working agreement is entered into which usually takes the form of the Native Commissioner attending to native reserves and lands in native occupation, whilst the Magistrate deals with the farmers. Each district of this type, however, constitutes a separate problem and various working arrangements are entered into to meet the position. It is, however, the Magistrate's duty to see that an effective working arrangement is made in his headquarter district.

The Superintendent of Natives at Fort Victoria exercises additional control over the districts which are served by that town as the railhead in respect of transport of supplies.

The D.C.L.O.'s are assisted by the police in all districts, and in certain districts the local police are in charge of sub-districts under the D.C.L.O.

The D.C.L.O.'s are responsible not only for the conduct of operations but also for intelligence at all times and the enforcement of the Locusts Destruction Ordinance, 1918. Under this Ordinance landowners are required to report egg-laying and appearance of hoppers on their land and to undertake destruction of the latter. The Government undertakes the destruction of hoppers on Crown lands and in native reserves. The Native Commissioners have the power to turn out the natives for locust destruction on lands in native occupation.

Intelligence is supplied by the D.C.L.O.'s (as above), by Native Department officials, Police and other Government officials in districts, Railway staff (through kind co-operation) and by the public generally. Farmers are permitted free telephone calls to the nearest Magistrate's or Native Commissioner's office or Police Station, for the purpose of reporting movements of swarms, egg-laying or appearance of hoppers. Letters and postcards dealing with such matters if addressed to a responsible official are carried free of charge. In the remoter parts of the Colony much reliance has to be placed on natives reporting swarms and such information is apt to be belated.

Methods Used in Destruction.—Recent developments in respect to the technique of hopper destruction rendered a

decision as to the methods to be employed in the past campaign a rather responsible matter.

The use of arsenite of soda as a *dry powder* has recently been considerably developed in the Union of South Africa. This method has an obvious advantage in doing away with the serious item of water transport, and when the poison is simply shaken through small holes in the containing tin the method does away also with the necessity for any machinery for distribution, *e.g.*, pumps. Its use therefore presents highly attractive possibilities. As preparations had to be completed in advance of the hatching of hoppers it was not possible to defer a decision until the method could be tested in the Colony.

The country presenting conditions most similar to Southern Rhodesia, namely, Northern Rhodesia had, however, had some experience with the Red Locust and the advice received in reply to a letter to the Secretary, Department of Agriculture, was that the dusting method had revealed serious drawbacks and that spraying was to be preferred wherever water was available.

Use of *poisoned baits* has been reported to have given very good results in Kenya and some other African States, but the information available suggested that its efficiency was considerably affected by conditions and that it was not everywhere effective. Baiting is a very economical method, but it would have been very unwise to have relied upon it without testing it in the Colony. Unfortunately one cannot change methods readily in the midst of a locust campaign.

It was decided therefore that reliance would need to be placed upon *spraying* as in the campaign of 1924. This decision involved the purchase of a considerable number of additional pumps, renewal of parts, etc., but subsequent experience fully justified it.

In actual fact any other decision would apparently have resulted in disaster, as experiments with dusting and baiting carried out later did not give fully satisfactory results.

It will be noted that the only methods seriously considered involved the use of poison. Certain other methods have given good results under particular conditions, but none are suitable

for such large scale operations as are involved in this Colony. Some necessitate a trained staff of operators which is not available in the Colony. It is to be realised that the sporadic appearance of locusts in Southern Rhodesia has been a severe handicap, as it has afforded no opportunity of building up an experienced locust service.

The Campaign.—The material remaining from the cam-was slightly over £12,000, including the purchase of pumps approximately ten thousand (10,000) gallons of concentrated arsenite of soda solution (10.5 lbs. of 80% Sodium Arsenite per gallon).

In anticipation of the campaign these pumps were overhauled and repaired and orders were placed for more pumps to be manufactured in Johannesburg. The total number of pumps in final operation amounted to 4,042, including a small number of imported pumps purchased locally.

Further supplies of poison were obtained in the form of powdered arsenite of soda manufactured and packed in the Union of South Africa according to the specification of the Government of that Dominion. The total amount of poison purchased in the powder formed amounted to 70 short tons, so that the total amount of arsenite of soda provided for the campaign was equivalent to about 120 short tons (2,000 lbs.= 1 short ton). In addition a not inconsiderable amount of cattle dip was also utilised.

Supplies were distributed to the districts in anticipation of the campaign and the necessary arrangements were made concerning transport, hire of European supervision, labour, etc.

The first hatchings recorded were those of the Tropical Migratory Locust in the Zambesi Valley, Darwin district, on December 15th, 1932. Exactly a month later (January 15th, 1933) the first hoppers of the Red Locust appeared in the Shangani Native Reserve in the Bubi district.

The distribution of Tropical Migratory Locust hoppers on the higher veld was more or less limited to a few districts in the north-eastern part of the Colony, including the populous and agriculturally developed Mazoe district. These hatchings were successfully dealt with.

It soon became apparent, however, that hatching of Red Locust eggs was occurring on a tremendous scale in many districts and, as much of the country involved was remote and difficult of access in the wet season, great difficulties were encountered. Even in the more accessible districts egg-laying had obviously occurred extensively amongst the hills from which the hoppers continued to descend on to the lower ground, where they frequently threatened cultivated lands. In these circumstances the battle seemed endless. Swarm after swarm would be destroyed and still further swarms appeared. The farmers are particularly handicapped under these circumstances, because during the growing season all the labour on the farms is required for agricultural operations, the farms are mostly large and the amount of work involved in fighting a serious infestation of hoppers is very considerable.

An attempt has been made to obtain a record of the number of swarms destroyed by the farmers and landowners during the campaign, but has been unsuccessful. There is no doubt, however, that it amounted to a very large total.

On Crown lands, unoccupied farms and in native reserves the work of destruction was carried out directly by the Government, these activities being extended in certain instances to occupied farms where on account of lack of sufficient labour or other reasons the work was not being carried out effectively.

The total number of supervisors and labourers specially employed by the Government amounted to 60 Europeans and 645 natives, but the services of police, Native Department officials, tsetse fly rangers, game wardens, foresters and other Government employees were also freely utilised. The natives in the reserves and on land in native occupation only were, of course, required to give their services without payment. The gangers on the railways dealt with hoppers appearing in the "railway strip" and rendered valuable service.

Estimates of the amount of destruction achieved on the basis of swarms destroyed is excessively unsatisfactory, although an attempt has been made to keep a record. A swarm is far too variable a unit to convey a reliable impression. The returns actually forwarded make a very large total indeed, but the reliability of the figures in some cases is questionable and, as stated, the returns are incomplete.

A better index is probably afforded by the amount of poison consumed, in terms of gallons as diluted for use. This amounted roughly to four and a half million (4,500,000) gallons, which would allow of the equivalent of 100,000 swarms, each of which required on an average forty-five gallons of poison to destroy.

Notwithstanding the large scale destruction achieved it was only in a few districts that the swarms were approximately exterminated. In most districts a considerable percentage survived, although it is judged that in the greater proportion of these the survivors were in a considerable minority.

Since the conclusion of the campaign winged swarms of the Red Locust of considerable size have been in evidence in various parts of the Colony, but a number of very large swarms are known to have invaded the Colony from across the eastern border. A few Tropical Migratory swarms were reported in the Colony up to April 4th, but since that date all specimens and reports have referred to the Red species. The Tropical Migratory Locust seems temporarily to have left the Colony.

The total expenditure on the campaign in this Colony was slightly over £12,000, including the purchase of pumps, which still remain for future use. It is to be realised, of course, that pumps and poison remaining on hand from the previous campaign represented a value of about £4,000.

Damage to Crops.—There is no doubt that the locust invasion has been responsible for a considerable amount of damage to crops, especially native crops, but there is also no doubt that in default of the measures taken there would have been practically no grain crop at all in this Colony last season.

Although the invading swarms in November and December were large and numerous and fed freely; crops attacked at this stage seem mostly to have recovered or to have been replanted in time. The European farmers in general succeeded in defending their crops against the ensuing hoppers, although certain individuals suffered severely, due to an overwhelming hatching out of hoppers on their farms and shortage of labour. Immediately after obtaining wings the locusts fed voraciously and some farmers who had been successful in defending their crops from hoppers but had late maize in their lands, had the

unfortunate experience of losing heavily from the fliers. No estimate can be made, at least at present, of the total value of the European crops destroyed, but it cannot be said that in the aggregate it materially affected the total crop for a climatically bad season.

Damage to native crops was affected by various factors, including the amount of energy displayed by the natives in defence, and the remoteness or otherwise of the locality from communications.

A large portion of the Colony suffered severely from drought and the native crops were doomed to failure in any case. In these circumstances the natives were entirely indifferent and with good reason were unwilling to make any effort to destroy hoppers. In other parts of the Colony, particularly in the north-east, the crops were usually good, and these crops were mostly saved by energetic measures on the part of officials and natives combined.

The natives are required by law to destroy hoppers in their reserves, etc., whatever their attitude towards loss of their crops may be, but in many districts the officials in charge had to contend with general apathy.

It is unfortunately not the instinct of the natives to contend strenuously with misfortune. Resignation appears to have become an inherited habit. Apart from this point the natives do not regard locusts as by any means an unmitigated misfortune; in fact, they commonly welcome the appearance of swarms with every manifestation of delight at a prospective feast. In these circumstances, if they have no great interest in their crops, they cannot be expected to destroy hoppers with enthusiasm or even to report their presence.

As far as the European population is concerned, whilst agricultural farmers are intensely interested in locust destruction, the same cannot be said of all those whose operations are confined to ranching. The ranchers are not greatly concerned in a locust invasion and it must be admitted that, on account of usually having large holdings and a limited supply of labour, they are in a difficult position. It should be mentioned in this connection that no reports of serious destruction of grazing by the locusts have been received.

The aim has, however, been to induce all landowners to do what is humanly possible to reduce the scourge on their lands, and the response on the whole has been reasonably satisfactory. Government assistance has been rendered in special cases.

General Considerations.—When a large and very partially developed colony sustains a heavy locust invasion and it is known that a general campaign is not being waged in neighbouring territories, the question of policy assumes great importance. It would appear that all that can be done in one Colony cannot have any material effect on the general swarm cycle in progress, which includes a number of territories. Even if the impossible ideal of complete extermination were attained in the one Colony invasion by winged swarms from its neighbours appears inevitable. In these circumstances it may appear that the most economical procedure would be to concentrate on defence of crops, both European and native, and to avoid the expense of carrying out operations in uninhabited country and over large tracts of purely pastoral land.

The decision reached was, however, to destroy hoppers wherever possible, and this decision appears to have been justified by recent experience.

Both the Tropical Migratory and the Red Locust are capable of a great deal of damage to late crops immediately after attaining wings, and if large numbers were allowed to mature in proximity to agricultural areas they would constitute a serious and immediate menace. Also, as anticipated, the movements of the Red Locust have not been of a definitely migratory character since attaining wings. The swarms show a tendency to drift in a westerly or north-westerly direction, probably due to the direction of the prevailing wind (S.E.), but the winds have not been very strong or continuous and the drift has been comparatively slow. Many movements in the opposite direction have also been recorded. Consequently, apart from some large swarms which have crossed the eastern border of the Colony, it is judged that the Colony is still benefiting from the reduction brought about by the campaign. This advantage is liable to disappear if and when large migrationary movements recommence in the spring, but by that time the winter crops will, it is hoped, have been reaped.

Policy re Winged Swarms.—The Government is not infrequently urged to adopt an active policy against winged swarms in the Colony, and various suggestions intended to be of a practical nature, have been put forward. Most of these are based upon the use of aeroplanes.

It may interest the general reader that the use of aeroplanes against winged locust swarms is receiving serious scientific attention at the present time. The measures is, however, still very much in the preliminary experimental stage and the necessary research with the object of evolving a practical method of procedure can best be carried out under the Imperial Government, which can command the necessary resources in personel and material. Southern Rhodesia is not in a position to do very much at the present stage. The comparatively loose nature of Red Locust swarms seems likely to prove a handicap in reference to any attack from the air on flying swarms of this species.

Another idea considered was that motor lorries equipped with spraying appliances, personel and necessary material should be kept in readiness, like fire engines, at selected centres and should proceed out to attack any swarm reported settled for the night within reasonable distance.

One difficulty with an arrangement of this nature is that, in order to have any chance of inflicting appreciable destruction on swarms resting overnight, a large number of lorries would be necessary and that these, with the "crew," would have to be maintained in idleness for considerable periods.

Furthermore, except by telephone, communications in the country districts are slow and the farm telephone system only reaches a small portion of the farming community, except in one or two districts.

Also, the adult swarms when resting do not always lend themselves readily to effective attack from the ground. They tend to cover a large area and may be in comparatively loose formation, although they tend to gather very thickly on trees, the branches of which may break beneath their weight. With power sprayers and "spray guns" a great deal of execution could no doubt be effected under favourable conditions, but

the cost per unit of winged locusts destroyed in this way would undoubtedly greatly exceed the cost of destroying a similar unit of hoppers. Moreover, comparatively few swarms are likely to be accessible to motor lorries.

On the whole therefore the expenditure involved seems likely to be out of proportion to the results secured.

It is possible that more effective work might be performed by aeroplane, as far as the actual destruction of resting swarms is concerned, but specially constructed aeroplanes are necessary for this class of work, and the economy of attempting anything along these lines on the basis of present experience is very doubtful.

It is realised that efficient and economical methods of attacking locusts in the adult stage are greatly to be desired, but it would be foolish to incur any considerable expenditure without a reasonable prospect of compensating results.

At the request of certain farmers an attempt has been made to issue warnings of the approach of any considerable swarms so that preparations can be made in advance to defend growing crops. There are great difficulties associated with both collection of the necessary information and its dissemination. It is obvious that speedy communication in both directions is essential if the information is to be of any value. As already mentioned, free telephone calls to the nearest Magistrate's or Native Commissioner's office or Police Station in reference to locust matters have been arranged. The assistance of the farmers' associations has been enlisted with regard to the prompt reporting of locust movements. The district officials notify neighbouring districts when swarms are reported moving in their direction. Information received at the local headquarters is passed to the local postmaster for dissemination along the party lines, special "locust calls" being arranged for this purpose.

The scheme is, of course, very imperfect, largely due to the fact that only a minority of the farmers are on the rural telephone system, but in any case the unavoidable necessity for relying to a large extent on voluntary reporting of locust movements is a fundamental weakness.

The Prospects for Next Season.—Swarms of the Red Locust are reported to be prevalent in adjacent territories on three sides of Southern Rhodesia. Some enormous swarms have been described in official reports.

There seems nothing to indicate imminence of a collapse of the present swarm cycle. Whatever occurs with reference to the Tropical Migratory Locust the outlook as far as the Red species is concerned is very disquieting.

Presuming that the large migratory movements which resulted in egg-laying in the Colony during the past season are repeated in the coming spring and take a similar direction, there appears to be every prospect of exceptionally heavy invasion of the Colony from Northern Rhodesia and Northern Bechuanaland.

Swarm cycles of the Red Locust seem in the past to have culminated in several years prevalence of this species in Southern Mocambique and Natal. The swarms of the present cycle have not as yet reached this region, but presumably they are likely to do so when the next big movement takes place. It may happen that next spring Red Locust swarms will fly from Southern Rhodesia in a south-easterly direction and that their place will be taken by other swarms following in the same direction. In that case the exchange seem likely to be very much to the detriment of Southern Rhodesia.

It is not, of course, possible to prophesy what will happen with any certitude. The scanty records available concerning former swarm cycles in the Colony indicate that the Brown and Red species continued to be more or less abundant over a series of several years, but the heavy invasion by the Brown Locust in 1924 was not repeated. The factors which brought this cycle to an end were, however, reasonably clear. There seems little probability of similar factors operating in the case of the Red Locust before next wet season, and taking everything into consideration it is reasonable to judge that the end of the visitation is far from being in sight at present.

Ultimate Prospects of Locust Control.—It is recognised by all who are competent to form an opinion that, even in circumstances when all invaded States are in a financial position to wage war against invading swarms of locusts, such efforts

cannot have much more than palliative results, particularly in such a country as Africa. Destruction of invading swarms does not affect the root of the trouble and all efforts it has been possible to make to date have probably had little effect on the duration of the swarm cycle.

In the course of the present article the writer has used the term "swarm cycle" freely, and no doubt the meaning of the term is clear enough in a general way.

The obvious question arises as to what locusts are doing when they are not experiencing a swarm cycle.

It may not be generally known that, during the recent prolonged period when swarms of the Red Locust were absent from Southern Africa, no one knew where this species was perpetuating itself. It appeared in Central Africa in swarms before it spread to Southern Africa, but during a period of about twenty years it was not in evidence anywhere, although as a matter of fact a few specimens were captured in Southern Rhodesia some five years after the last swarms had disappeared, namely, in 1915.

Recent research has demonstrated two factors in reference to certain species of swarm locusts, namely, (1) that when not swarming they live as solitary grasshoppers, and (2) that this solitary phase may be more or less limited to certain permanent breeding grounds where the insect is always present and is not a sporadic invader as elsewhere.

The position is that a locust is really a grasshopper which under certain conditions increases vastly in numbers and assumes swarm formation. When this occurs the permanent breeding grounds send out swarms of fliers which breed temporarily in the invaded country, and the new generations fly further and further afield until unfavourable conditions and increase of parasites and disease bring the swarm cycle to an end. The swarms gradually die out in the invaded areas or possibly some return to the permanent breeding grounds.

Permanent breeding grounds where the solitary phase occurs are apparently not all suitable for producing the swarm phase. Certain species are known in the solitary phase in areas where the swarm phase has never been seen.

In the Union of South Africa permanent breeding grounds of the Brown Locust have been located in certain parts of the Karroo and adjacent territory. The policy of the Union Government is to keep the swarm phase from developing in these localities, the practice being to watch the position closely and to destroy any swarms as soon as they begin to form.

As far as can be judged to date, the policy appears to be succeeding and, if the Union Government is able to keep this species permanently suppressed in this way, it is obvious that Southern Rhodesia will share in the protection afforded to the rest of the Union.

An effort is now being made to find out whether the permanent breeding grounds of the Red Locust and other species are sufficiently localised for similar control measures to be undertaken. At present the location of the permanent breeding grounds of the Red Locust is not known. The work is being carried out under the direction of the Committee on Locust Control of the Economic Advisory Council in Great Britain, and Southern Rhodesia is making a small contribution to the funds.

This line of research may lead to the eventual full control of the locusts which tend to invade Southern Rhodesia, and such invasions may become a thing of the past.

The map illustrating this article shows the maximum distribution of the breeding of locusts in the Colony during the past season.

Gum Poles For Sale at Mtao Forest Reserve.

A limited quantity of gum poles is for sale at the Mtao Forest Reserve.

A small quantity is already cut, and a further quantity will be cut as orders are received.

Owing to the fact that the poles to be cut are thinnings only, the sizes are small. They would be suitable for scaffolding, building, telephone and wireless poles and small mining timber.

Prices are quoted below for the principal sizes, but a small quantity of larger sizes will be available, prices of which may be had on application.

	Diameter at Butt:					Overbark:
Length:	1in.-2in.	2in.-3in.	3in.-4in.	4in.-5in.	5in.-6in.	6in.-7in.
6 feet ...	1d.	2d.	4d.	6d.	9d.	1/-
8 feet ...	1½d.	3d.	5d.	8d.	1/-	1/4
10 feet ...	2d.	4d.	6d.	10d.	1/3	1/8
12 feet ...		5d.	7d.	1/-	1/6	1/8
14 feet ...		6d.	8d.	1/2	1/9	2/4
16 feet ...		7d.	10d.	1/4	2/-	2/8
18 feet ...		8d.	1/-	1/6	2/3	3/-
20 feet ...		9d.	1/2	1/8	2/6	
22 feet ...			1/4	1/10	2/9	
24 feet ...			1/6	2/-	3/-	
26 feet ...			1/8	2/2	3/3	
28 feet ...			1/10	2/4	3/6	
30 feet ...			2/-	2/6	3/9	
32 feet ...						
34 feet ...						
36 feet ...						

TERMS.—C.W.O. Prices are F.O.R. FAIRFIELD SIDING.

Deduct 5% for delivery at plantation.

Orders will be dealt with in strict rotation.

Apply to the District Forest Officer, Mtao Forest Reserve, P.B. UMVUMA.

Locust Invasion, 1933.

SOUTHERN RHODESIA.

Monthly Report No. 9, August, 1933.

There is little change in the general position.

1. **Tropical Migratory Locust** (*Locusta m. migratorioides*).—No records of this species in the Colony have been obtained during the month.

2. **Red Locust** (*Nomadacris septemfasciata*).—The swarms of this species appear to be exhibiting greater activity and to be more conspicuous with the advent of warmer weather. They seem also to be becoming more hungry, and loss of at least one extensive irrigated crop of wheat is reported.

Entomologists may note that the flying swarms of this species now exhibit the full red colouration associated with migratory swarms, but that the purplish pink suffusion at the base of the hind wing is still very irregularly developed. Certain large swarms early in the month showed practically no development of this suffusion.

Red Locust adults kept continuously in cages have not developed the swarm colouration, but remain brown with the median light stripe down the pronotum and elytra conspicuous. These specimens show strong development of the purplish pink suffusion at the base of the hind wings and, probably owing to lack of exposure to the sun, this suffusion is notably dark. It appears clear that the development of this suffusion is not corelated with the development of red pigment on the chitinous parts of the integument.

There were no signs of egg development to the end of the month.

Reports from neighbouring States reveal a very grave position in reference to the Red Locust, and all indications point to a further heavy invasion of the Colony when the large migratory movements commence. The Union of South Africa has now been invaded by the Red Locust. Swarms have penetrated Zululand and Natal, apparently from Mocambique. The Transvaal has been invaded by swarms thought to have come from Bechuanalnd.

RUPERT W. JACK,
Chief Entomologist.

Southern Rhodesia Veterinary Report.

JULY, 1933.

AFRICAN COAST FEVER.

There has been no mortality at any of the existing centres of infection.

TRYPANOSOMIASIS.

There were eighteen cases in Melsetter district.

ANTHRAX.

One suspected case occurred in the Mazoe district in an old infected area and all the cattle were inoculated.

MALLEIN TEST.

Seventy-six horses were tested on importation with negative results.

EXPORTATIONS.

To the United Kingdom, *via* Union Ports in cold storage: Forequarters, 8,175; hindquarters, 8,577; veal carcases, 36; boned meat, 164,379 lbs.; livers, 20,815 lbs.; tongues, 23,734 lbs.; hearts, 17,842 lbs.; skirts, 8,979 lbs.; shanks, 4,930 lbs.; tails, 5,857 lbs.; kidneys, 338 lbs.

Southern Rhodesia Weather Bureau.

AUGUST, 1933.

Pressure.—Mean barometric pressure was a little above normal for the month. Numerous highs affected the country and one deep low passed through on the 28th and 29th.

Temperature.—Mean maximum temperatures were lower than usual, and mean minimum temperatures above normal in the South and Midlands. The mean temperature did not vary much from the normal.

Rainfall.—One or two light showers fell in the Midlands on the evening of the 19th. Apart from this only the usual orographic drizzle was recorded, mainly over the Eastern Border.

AUGUST, 1933.

Station.	Pressure Millibars, 8.30 a.m.		Temperature in Stevenson Screen °F.								Rel. Hum.	Dew Point	Cloud Amt.	Precipitation.		
			Absolute.		Mean.											
	Mean.	Normal.	Max.	Min.	Max.	Min.	½ Max. Min.	Normal.	Dry Bulb.	Wet Bulb.	%	F.	0-10	Ins.	Normal	No. of Days
Angus Ranch... ...	...	...	88	44	76.6	52.2	64.4	64.2	57.7	51.5	65	46	...	Nil	...	...
Beatrice	...	...	83	27	76.4	39.3	57.8	...	58.9	50.4	54	42	1.1	Nil	...	...
Bindura...	896.8	...	86	39	76.6	46.4	61.5	...	59.2	51.1	56	44	0.5	Nil	...	...
Bulawayo	873.7	872.5	83	41	73.7	47.2	60.5	60.8	57.9	49.2	53	40	2.4	Nil	...	...
Enkeldoorn	862.0	...	81	37	72.0	45.5	58.7	59.9	57.7	50.2	59	43	1.9	Nil	...	...
Essexvale	...	...	91	35	80.0	44.7	62.4	60.7	53.5	48.6	70	44	...	Nil	...	...
Fort Victoria	900.8	900.5	87	37	73.4	44.6	59.0	58.6	57.0	50.5	63	44	2.8	Nil	0.1	...
Gatooma	...	...	86	34	80.1	44.7	62.4	63.3	58.0	50.3	58	43	0.5	Nil	...	...
Gwanda	911.6	...	89	38	75.4	47.8	61.6	...	59.5	51.3	56	43	2.3	Nil	0.1	...
Gwelo	867.5	...	83	37	73.6	44.7	59.2	59.6	57.4	49.5	57	42	1.7	Nil	0.1	...
Inyanga	840.1	...	78	33	67.7	42.8	55.2	...	58.5	48.1	44	36	2.1	Nil	0.1	...
Manchester...	...	...	78	36	62.8	44.4	53.6	..	50.8	48.0	82	45	...	1.24	...	6
Miami	883.2	...	84	40	75.4	47.4	61.4	...	61.5	53.3	57	46	0.5	Nil	...	...
Mtoko	881.9	...	85	44	74.2	49.6	61.9	...	61.8	53.5	57	47	0.9	Nil	...	...
New Year's Gift...	...	...	90	41	75.8	50.4	63.1	...	59.4	53.5	68	49	...	0.24	0.1	4
Nuanetsi	867.2	...	96	...	78.7	...	...	...	64.1	55.1	56	48	2.1	0.03	...	1
Riverbank...	...	...	91	37	80.0	47.8	63.9	62.4	58.0	49.6	54	42	...	Nil	...	...
Riverdene North	...	...	88	31	75.6	40.7	58.2	...	53.5	48.8	71	44	...	0.06	0.1	2
Rusape...	866.6	...	82	32	70.9	42.9	56.9	...	56.3	49.3	60	43	2.0	Nil	0.1	...
Salisbury	858.9	858.9	81	34	74.8	45.1	60.0	59.6	58.8	49.8	52	41	0.3	Nil	...	...
Shabani	912.8	...	90	42	74.7	50.9	62.8	...	59.3	52.1	61	45	3.3	0.01	...	...
Sinoia	892.5	...	87	34	79.6	41.2	60.4	...	60.4	51.6	54	44	0.5	Nil	...	...
Sipolilo...	889.5	...	85	43	75.5	49.1	62.3	...	61.3	53.3	59	47	0.5	Nil	...	...
Stapleford...	...	...	76	27	62.5	39.1	51.8	...	52.1	49.2	82	46	4.3	0.85	0.6	5
Umtali...	898.2	897.5	86	42	72.2	49.5	60.9	61.4	59.9	53.7	66	48	3.4	0.43	0.2	4

Farming Calendar.

OCTOBER.

BEE-KEEPING.

Bush bloom is now on, the queens consequently are laying vigorously, therefore give space and ventilation. In good districts, where stocks are strong, nectar may be coming in freely, and to prevent swarming it may be necessary to remove a crate of honey. By using the carbolic cloth, the operation is easily and quickly accomplished. At this season, whenever a crate of honey is removed, a properly fitted empty crate must take its place, otherwise the bees will swarm. Keep the apiary clear of weeds, and all hives well shaded. Feed any weak stocks.

CITRUS FRUITS.

Citrus trees should not be permitted to suffer for want of water if a good setting of fruit is desired. Continue irrigation at fairly frequent intervals, especially if it is windy. Cultivation must follow each irrigation when the soil is fit to work, otherwise a large amount of moisture will be lost by evaporation. The packing of late fruit for export should be completed early in the month or before the rains commence. If rains intervene, the carrying properties will be affected and the fruit will probably break down in transit. Suppress all stem growths or water shoots as they appear. Young trees planted last season may with advantage have the stems whitewashed or washed with Bordeaux mixture paste; this will prevent undue sun-scalding of the unprotected stems. Plant cover crops with the first good rains.

CROPS.

If not already attended to, overhaul all farming implements and replace worn parts to ensure efficiency. Shell ground nuts required for the season's planting. Ploughing of old lands should, at latest, be finished this month. If seed potatoes will not keep in good condition until next month, they may be planted now, but later planting is better. Edible canna may be planted this month before rain falls. Also velvet beans, dolichos beans and sunn hemp towards the end of the month for green manuring. Harvest winter cereals and plough under the stubbles as soon as possible after harvest. When rains have fallen, use every effort to improve the tilth of the lands which will be the first to be planted. On cloddy lands already ploughed, seize the opportunity to break down the clods by disc and drag harrowing as showers of rain fall. A spiked roller is very useful for this work. A good tilth means good planting, and a good stand of maize; therefore, do everything possible by cross ploughing, disc and drag harrowing to bring the soil into good condition for seeding.

When necessary, keep the harrows going to check early weed growth. Clean lands at this time of year are an insurance against cutworm and other insect pests. If weather conditions permit, plant a trap crop of maize to attract the stalk borer. New land to be ploughed and intended for planting this season should be cleared of heavy grass or weeds by burning or cutting to ensure good work being done by the ploughs. Seasonal showers of rain are liable to spoil bricks unburned. See that bricks which have been made are protected from rain. Clean out guttering and down-spouts of house and farm buildings. Press on with development work so as to have this completed before rains break.

DAIRYING.

During the month of October and until such time as the rains have commenced and green grazing is available, dairy stocks require to be almost entirely stall fed. Cows in milk and cows due to calve should be liberally fed on succulents and concentrates in order that they may commence the dairying season in good condition, and make full use of the early grazing for milk production. Dairy cows that are underfed at this time of the year invariably produce milk of poor quality, and usually throw weedy undersized calves; furthermore, they do not pick up in condition until comparatively late in the season.

During October, the cow's ration should consist of succulents such as silage or green feed, etc., legume hay of good quality and a liberal allowance of concentrates; a pound or so of a feed such as ground-nut cake is invaluable for dairy stock at this time of the year.

Weather conditions are generally fairly warm during the month of October, and every precaution should be taken to keep the cream, which is used for butter-making or which is sent to the creamery, as cool as possible. The can or bucket containing the cream should be placed in a basin of water or concrete trough, in the dairy, and exposed to a draught; a piece of kaffir blanket, which dips into the water, should be wrapped around the can or bucket containing the cream. Churning of cream for butter-making is best carried out early in the morning—before sunrise if possible; the coolest water obtainable should be used for washing the butter whilst in the granular stage.

At this season of the year cheese-makers may find that the milk is deficient in butter fat; this is generally the result of under-feeding or unsuitable feeding. Cheese made from milk of low fat content is invariably dry and hard, defects that are accentuated by over cooking the curd or by cooking at too high a temperature. The curd should be firmed in the whey at a temperature not higher than 98° F. to 100° F.

DECIDUOUS FRUITS.

Keep all trees well watered until the rains commence; cultivate after each watering to prevent evaporation of added moisture. Rub off all undesirable shoots, such as those arising on the main stem near the ground; also those shoots having a tendency to crowd each other. Two or more shoots should not be allowed to develop from the same spot on any part of the tree. Rub off the weaker ones soon after they appear. The fruit of early peach trees should be thinned out if a heavy crop has set; this thinning will result in a crop of large-sized fruit. All fruit should be thinned out if necessary.

ENTOMOLOGICAL.

Maize.—Where circumstances permit early growth of maize crops planted late in October are liable to suffer in December from stalk-borer, especially if only a few acres are involved. If maize can be planted early in October, the plants are usually large enough in December to outgrow serious damage. Maize beetle is now in its pupal stage. Thorough working and smashing up of the soil at this time will destroy great numbers.

Tobacco.—See notes for last month, together with article in the "Rhodesia Agricultural Journal" for October, 1926, on "Baiting of Tobacco Seed Beds with Cyanogas Calcium Cyanide." The lands must be kept free from all weeds which caterpillars may feed on, and it is well not to have maize, tomato and Cape gooseberries near the lands; a clearing of some depth is advisable, which must be regularly weeded. If poisoned bait is put down, it has been found that a covering of sacking or leaves will help to retain moisture and thus give further attraction, especially at this time

of the year. In order to lessen the heavy infestation of caterpillars and other insect pests in the seed beds, coverings of hessian or cheese cloth should be kept over beds, especially at night; cutworm moths are nocturnal in habit, so that the coverings of the beds need to be moth-proof at night. Notwithstanding precautions in the covering of the beds, insects will enter, and after the emergence of the seedlings a weekly spraying should be carried out. Lead arsenate at the rate of 1½ ozs. (powder) or 3 ozs. (paste) in a 4-gallon petrol tin can be sprayed on the plants once a week to keep insect pests in check. Lead arsenate can be safely used with Bordeaux mixture, the constituents not reacting upon one another. The two combined sprays act as a preventative and deterrent to insect and fungoid troubles.

Cotton.—Thorough cultivation and keeping down of weeds should be resorted to in order to lessen the infestation of over-wintering pupæ, by exposure to the sun, and birds.

Potato.—Avoid introducing root gallworm and potato diseases to valuable land under irrigation or to the home garden with seed potatoes. Growing plants in October may be defoliated by caterpillars, or the tops severely injured by the potato tuber moth. Spray with arsenate of lead (powder), 1 lb. to 30 gallons of water; or (paste), 1 lb. to 16 gallons of water.

Cabbage, Turnip, etc., are apt to suffer severely from diamond back moth and webworm. Dust regularly with Paris green, 1 lb.; fresh water-slaked lime, 20 lbs. For cabbage aphis, water liberally, and wash plants regularly with a forceful stream of water from a hose or spray pump.

Beans and Peas are little attacked by insects at this time of year. If aphis (green fly) is troublesome, the plants may be sprayed with soap wash or tobacco wash. Leaf-eating beetles are best destroyed by hand.

Cucumbers, Marrows, etc., may be attacked by leaf-eating beetles, which quickly destroy the young plants. The young plants may be protected by gauze covers. Once vigorous growth has started, the damage is negligible.

Citrus.—All out-of-season fruit should be removed by this time. Destroy all fruit "struck" by the false codling moth. Aphis may be controlled by very careful spraying with the combined "Lime-Sulphur-Nicotine" spray (for details see "Rhodesia Agricultural Journal," September, 1926, page 871), while the yellow thrip may also be kept in check by this spray. Avoid using miscible oils for citrus spraying. A careful search should be made for the American bollworm (*Heliothis obsoleta*).

Deciduous Fruit Trees, including grape vines, are liable to attack by chafer beetles. Heavy spraying with lead arsenate (paste), 1 lb. to 10 gallons of water, or (powder), 1 lb. to 20 gallons, appears to afford considerable protection, but the leaves need thoroughly coating.

Fig.—Fruit infested with fig weevil should be collected regularly and destroyed.

FLOWER GARDEN.

All flower seeds, annual and perennial, may be sown as in September. A word or two on open seed beds may not be out of place here. These beds should be prepared in a sheltered position, and the soil should be well and deeply dug. This is most essential, as in this state the soil when once watered is more easily kept moist, and is not so liable to cake. The top dressing should be free from all undecayed vegetable matter, and when sown, the seeds should be covered with a thin dressing of fine light soil, over which a thin covering of grass may be placed to check evaporation.

Transplanting from boxes or beds should be done on a dull day or towards evening; the plants should be well watered before being removed, and the roots disturbed as little as possible, care being taken that the latter have their full depth and spread when planting.

VEGETABLE GARDEN.

As in September, nearly all vegetable seeds may be sown. Early potatoes should be earthed up when reaching the height of about eight inches. In planting a small amount of marrow, melon, cucumber, and pumpkin, the writer has found it economical to sow the seed one in a tin and transplant when about four inches high in hills. A few cucumbers planted in this manner yielded nearly 400 a week for about two months. Sweet corn and maize may also be sown this month.

FORESTRY.

The main sowings of Eucalypt (gum) seed should be made either in seed trays or in well prepared seed beds. A well-broken soil forming a fine tilth in the seed bed ensures more successful germination and better plants. If transplants are being used, any seedlings which are ready should be pricked out.

Seedlings in open beds may have their tap roots cut so as to develop fibrous lateral roots, and thus produce good type stocky plants. Remember the plant feeds through its roots, hence the better the root system the healthier the plant and the greater its chances of successful establishment. If conditions are favourable, cross-plough and harrow land for planting broken up in early autumn.

POULTRY.

October is usually a hot month, and poultry keepers should therefore see that their birds have access to shade during the day. At the same time they should have plenty of air. One often sees birds during hot weather sitting under dense bushes, which is almost worse than no shade at all.

All houses should be examined and, if necessary, repaired. It is advisable to repeat the caution that birds must have dry quarters.

Many poultry keepers do not realise the vital necessity of giving their birds, especially the young stock, plenty of succulent green food during the hot weather. It should be cut up and placed in boxes or hoppers about 7.30 a.m. and 5 p.m., and, if very hot, also at noon; it should never be placed in the sun. As much as the birds will eat should be supplied. Lack of it, especially during hot weather, causes a reduced output of eggs, smaller eggs and light-coloured yolks; further, a disease known as "nutritional disease," is likely to affect the birds and cause deaths. The symptoms are much like those of eye roup, without the well-known offensive smell of roup. It is due to the fact that vitamine A, which is present in large amounts in all succulent green foods, and which is so necessary for nutrition, is lacking. There is no doubt that many chickens and fowls die each year from this cause.

Ducks.—These during the hot weather require even more shade than do fowls; they cannot stand the direct rays of the sun nor sultry heat. The houses should always have dry floors, and should be overhauled before the rains commence. Ducks sleeping on damp floors often contract rheumatism and carmp. The floor of the duck house should be raised a few inches, thus ensuring a dry bed.

As many ducklings should be hatched as possible now, provided, of course, there is the prospect of a sale for them at ten weeks old. They thrive best in the wet weather.

Turkeys.—Stop hatching until after the wet season is over. To rear turkeys in the wet weather entails a good deal of time, labour, expense and often losses. Once a young turkey chick gets wet, it will probably die; at any rate, it will never be the same bird it would have been had it not got wet. Give the older turkeys all the range possible; the further afield they go, the better grown birds they become, and less is the expense of feeding. See also that their roosting quarters are water-tight before the rains commence.

STOCK.

Cattle.—Ranching cattle on granite veld will in many instances be in fairly good condition on account of the early grass in the vleis, etc. On the diorite soils and later veld the cattle owner will still have to watch his weaker cattle carefully. In any case all supplies of hay, ensilage, majordas, etc., should be carefully husbanded in anticipation of possible late rains, but at the same time every effort should be made to prevent cattle becoming weak. Dairymen will need to feed highly both with succulents and green foods. Calves should be weaned and branded if this has not already been done, and care should be taken that they do not suffer any serious setback by reason of want of feed. The question of a mineral mixture should receive consideration.

Sheep.—If spring lambs are expected, one should see that the sheep-shed is in order, and that there is a supply of hay, ensilage or mealies for the poorer ewes in the event of late rains. All drinking places should be cleansed out, and care taken that the water supply is sufficient. Ewes for winter lambing should be well looked after, so as to get them up in condition before they are put to the ram next month. General shearing may start, including the April-May lambs.

TOBACCO.

Continue to sow seed beds. Where grass has been put on the seed beds to assist germination of seed a daily inspection should be made, and as soon as the first few plants make their appearance the grass should be raised up a little from the bed in order to prevent the plants growing "spindley." All possible preparation for the coming planting season should be made.

VETERINARY.

White scour is prevalent in spring—November and December—but dipping is eradicating this disease. There is still danger from vegetable poisoning, and it will only disappear when there is plenty of good grass on the veld.

WEATHER.

This is apt to be a hot, dry month, and rather trying, therefore, to man and beast, and the strong winds which blow at this season add to the general discomfort. Evaporation is, as a consequence, at its greatest at this time of year, and dams and pools lose most from this cause. The prevalence of veld fires at this time of year adds to the anxiety of the stock owner.

The rainy season has occasionally started early in October, but for practical purposes it need not be expected before the end of this month. The days are becoming warmer, and often even hot and oppressive. Clouds gradually collect, at first disappearing at sunset, but later becoming more persistent. Sheet lightning is usually frequent, and showers of gradually increasing severity mark that the rainy season has set in. Steps should be taken in advance to provide for the run-off after such torrential rains, otherwise serious loss may result.

The normal rainfall varies from three-quarters of an inch to an inch in the different portions of the country. The rain usually occurs in the form of thunder-showers, which are not long sustained and are fairly local, but the total rainfall experienced during the month does not vary much over the whole country, with the exception of the eastern border, where the rainfall is usually heavier.

NOVEMBER.

BEE-KEEPING.

Now that the first honey flow is on, be sure the hives stand level, whether working them for extracted or section honey. This is important, saving annoyance when preparing the product for market. Occasionally. where bees have not been thoroughly subdued, they object to the removal of honey; postpone the operation for 24 hours. Where increase of stocks is required. artificial swarms can now be made. Use care in storing honey.

CITRUS FRUITS.

If no appreciable rain has fallen, irrigation must be resorted to in order to keep the trees in good growth and to prevent any check to fruit development. This is a good month to plant green crops. Sunn hemp is possibly the best crop to smother weed growth and supply humus-forming material after it is ploughed in. If not already done, storm drains should be made on the sloping ground to prevent erosion of the surface soil during heavy storms. Where new plantings are contemplated, the holes should be dug and everything got in readiness for planting if the trees are ready for lifting in the nurseries. All unthrifty trees could with advantage have an additional amount of fertiliser and manure applied during the month. Keep down all water shoots.

CROPS.

Take note when the first rains fall, and see what leaks there are, if any, in the farm buildings. Do not neglect to effect such repairs as are necessary. Early in the month see that the planters are in perfect order, and that they drop the different seeds to be planted evenly and at the right distance. Try them out on the farm road. Hasten the work of getting the lands for early sown crops into as good a condition for seeding as possible, so that the first and most favourable opportunity for planting may be seized. The young plants make more rapid growth in a good seed bed. Utilise exceptionally early rains for this purpose rather than for planting. The holes for check-row planting of maize can continue to be prepared until sufficient rain has fallen to allow of planting. Velvet beans and dolichos beans for seed or hay may be planted dry if the land is in good order. With favourable weather, planting of maize, velvet and dolichos beans and cotton will commence about the middle of the month, and will continue as the condition of the land and the rainfall permit. Main crop potatoes should be planted from now on to January. Dhal may be planted for seed or green manuring—if for seed, a frost free situation is necessary. Kaffir corn for seed may be planted this month. Green-manure crops requiring a long growing season should be planted. Destroy, by feeding or burning, early planted trap crop of maize or volunteer plants which have become infested with stalk-borer.

If weeds are beginning to show, keep the harrows going in front of the planters. If weeds are too advanced to be killed by drag harrows and too numerous to be dealt with by hand labour. use the disc harrow or lightly re-plough the land. If the tilth is good, do not be afraid to harrow the young maize. This will save much labour later on by destroying the weeds while they are small.

DECIDUOUS FRUITS.

Continue thinning out fruit on the trees if a very heavy setting has occurred. A small amount of large-sized fruit is preferable to a large crop of small fruit. Thin down the inner growth of new shoots if they have a tendency to crowd each other, and stop all suckers and main stem growths as they appear.

ENTOMOLOGICAL.

Maize.—Crops planted before the last week in this month are liable to suffer later from stalk borer. At Salisbury, crops planted after 27th November have escaped serious injury, but early December plantings are probably the safest. Volunteer maize is commonly badly infested and should be cut out and removed immediately, otherwise the borers tend to spread to surrounding plants. If rain has fallen sufficiently early, lands may be baited at the end of the month against surface beetles, snout beetles and other pests which tend to reduce the primary stand of plants. The formula is arsenic of soda 1 lb., cheapest sugar 8 lbs., or molasses 1 gallon, water 10 gallons. Dip chopped Napier fodder or other green stuff and distribute broadcast. The poison may be sprayed over volunteer maize and weeds on land with good effect. Cutworms do not usually appear in numbers until December, except in low-lying lands. Succulent green stuff soaked in a 2 per cent. solution of sodium fluoride is the most recent formula for poisoned bait, but destruction of these pests is difficult. Keep the land clear of weeds as a preventive measure. If the young plants are attacked by the black maize beetle (heteronychus), the only remedy is to destroy by hand. Good, clean farming will control these pests to a large extent.

Tobacco.—This crop is subject to many pests in its early stages, although attacked by a few after vigorous growth has started. Keep cheese cloth covers on seed beds at night to exclude pests, and spray regularly with arsenate of lead (powder) 1 lb. in 30 gallons of water to protect against leaf-eating insects, etc. Lands may be baited against surface beetles with maize bran moistened with arsenate of soda 1 lb. in 30 gallons of water. Distribute in balls about the size of a golf ball and cover with branches or anything to protect from sun. Place one ball to each ten plants and moisten again when dry.

Potato.—The first brood of leaf-eating ladybirds appear in November. Spray with arsenate of lead (powder) 1lb. in 30 gallons of water. Spraying is also useful against the black blister beetles, which sometimes attack the crop on sandy soils. Keep the soil of irrigated crops well hilled and in friable condition as a precaution against tuber moth laying eggs on the tubers.

Kitchen Garden.—Plants of the cabbage family are liable to attack by diamond-back moth and other leaf-eating insects. When considered desirable, young plants may be dusted lightly with arsenate of lead (powder). Cabbage aphis may be kept in check by liberal watering and frequent washing with a forceful stream of water from a hose pipe or spray pump. Drenching the plants regularly with cold water is also held to be a good remedy for the diamond-back moth mentioned above.

Deciduous Fruits.—Young trees may need spraying with arsenate of lead (powder) 1 lb. in 20 gallons of water as a protection against chafer beetles, whose attack may check the growth very seriously. Choice varieties of early peaches may be netted to protect them from fruit-piercing moths.

When in doubt as to the identity of any pest or the method of dealing with it, apply promptly to the Chief Entomologist, Salisbury, bringing or sending specimens of the insects concerned. Note, however, that it is sometimes feasible to prevent injury from pests for which no practical remedy is known. Farmers should therefore endeavour to obtain some knowledge of the pests of the crops they are growing through the articles published in this Journal.

FLOWER GARDEN.

All seeds may now be planted. Annuals for January flowering should be sown, amongst which the following will be found to be excellently in this Colony:—Balsam, Calliopsis, Centurias, Chrysanthemum, Dianthus, Escholtzia, Marigold, Mignonette, Gallardia, Phlox. Poppy, Nasturtium, Nigella, Verbena and Zinnia. These are all hardy, and may be sown in the open either in beds or in the position desired for flowering. Advantage should be taken of each shower of rain during this month to keep the soil well worked and loose.

VEGETABLE GARDEN.

All vegetable seeds may be sown during this month. Tomatoes and early peas and beans should be staked. The soil should be kept loose and free from weeds, which now get troublesome. Sow pumpkins, mealies, peas and potatoes.

FORESTRY.

Sowings of eucalypt (gum) seed should be made for late planting. If fresh seed of cedrela toona is available, sowings should be made. Keep the seed beds moist and free from weeds. The tap roots of early seedlings may be cut back in order to form hardy, stocky plants most suited for planting. Continue with pricking out if transplants are to be used. Prepare all land to be planted by cross-ploughing and harrowing. A well prepared soil is a good fertiliser; it assists establishment and reduces failures.

POULTRY.

Some birds will now be commencing to moult. This will cause a decrease in the number of eggs laid. The poultry keeper, therefore, should see that his birds come through the moult as quickly as possible. Some birds will lay and moult simultaneously, but these are the strongest, most vigorous and the best layers; the majority do not. The process of moulting is a natural one, but it is a severe strain on the system. Fowls that are not too fat, and can stand extra feed at the commencement of the moult. come through it best. More green and animal food should be given, and the utmost care taken that they are not exposed to cold or wet, otherwise they will not only take longer to moult, but go off in condition. A little linseed stewed, or linseed meal, or ground nut meal and milk should also be given. There will next month be a demand for table birds, and such as the poultry keeper intends to sell should be selected. In making this selection, it is no use choosing old or scraggy birds, for it is hopeless to attempt to fatten these, or make them good table birds. Do not coop them up till a fortnight or so before they are to be sold give them free range and feed them well, with at least one feed of soft food mixed with milk once a day. Turkeys destined for the Christmas market should have free range, but also a feed of soft food once a day, and a good feed of mealies in the evening.

STOCK.

Cattle.—Normally rains should have fallen and the veld should be plentiful now. Beyond careful dipping, ranchers should not have much worry. If the season is bad, the poorer cattle should be drafted out and given a little hay, ensilage or maize daily. The grazing should be improving rapidly in feeding value. If normal rains have fallen. the grass should be sufficient for cows of average production. Heavier milkers should be fed concentrates at the rate of about 3 lbs. per gallon of milk produced over the first. In most cases maize meal alone will be sufficient for the purpose.

Sheep.—Dip sheep; put the rams to the ewes; keep the sheep on high dry land; be sure the kraal or sheep shed is dry and clean, and that there is shelter from the rain for young lambs.

DAIRYING.

In a normal year veld grazing should be plentiful in November, and the feeding of dairy stock is then very much simplified; veld grass in a green and succulent condition is practically all that is required for animals of less than average production. Heavy milking cows, however, on early pasture, require extra feed in the form of concentrates, while the latter should always be fed to dairy stock which are in poor condition at this time of the year. Young calves should not be turned out to graze with the herd, and in wet weather are best kept in a clean, dry, airy pen. Weaned stock, which have not hitherto had access to green pasture, should be gradually accustomed to the change in diet and may at first be turned out to graze for short periods. Young stock on pasture should also receive a small daily allowance of concentrates.

Farmers supplying cream to the creamery should adjust the cream screw to the separator so that the latter will separate a cream testing 45 to 50 per cent. butter fat. Cream of this consistency will keep better than thinner cream. It should be borne in mind that it is practically impossible to produce first-grade cream if the cattle are milked in a muddy kraal. In the absence of a cow shed, every endeavour should be made to erect a small milking shed in which four or five cows can be tied, milked and fed. A small shed of this kind is also essential to obtain clean milk for cheese-making. Milking in a muddy kraal invariably results in a gassy, bitter cheese being produced.

The shelves of the cheese room should be scrubbed with boilinig water and soda, and for the last rinsing a weak solution of formalin may be used. This should prove effective in controlling cheese pests.

TOBACCO.

Continue to sow seed beds, watering. etc. When early beds become overgrown and hard, pull out, dig up and re-sow. Begin transplanting with the first good rains, and continue as fast as the rains and planters will allow, until the crop is set out. Be careful to fill in the misses from previous transplanting before starting on new fields; use the stoutest and best plants for filling in, and try to get the tobacco from any one field to grow and come to maturity as near at the same time as possible. Discontinue filling in when the field has been planted for several weeks and has made a good start to grow, as the later filled in plants will be choked out by the earlier ones, and will not come to maturity. Cultivate fields as soon as plants are established, to keep down weeds.

VETERINARY.

Early heavy rains might bring on horse-sickness before its usual time, but as a rule it need not be feared till the first rains are over in December.

WEATHER.

The rains should be commencing, if not already begun; occasionally they have delayed until December, and even later, before setting in properly. Between spells of wet weather lasting several days, fine dry periods occur, at first clear, but later cloudy and thundery. gradually gathering to burst in thunderstorms. The mornings are generally fine, and rain falls chiefly in the afternoon or evening. Heavy downpours are to be expected, and should be provided against beforehand by means of ditches and embankments, and by clearing water ways and furrows. In a normal season the rainfall varies from two-and-a-half to three inches in Matabeleland, and from three-and-a-half to four inches in Mashonaland generally, with the exception of the eastern border, where it amounts to five inches. Between the rain periods and prior to the commencement of the rains, severe heat is likely to be experienced.

Departmental Bulletins.

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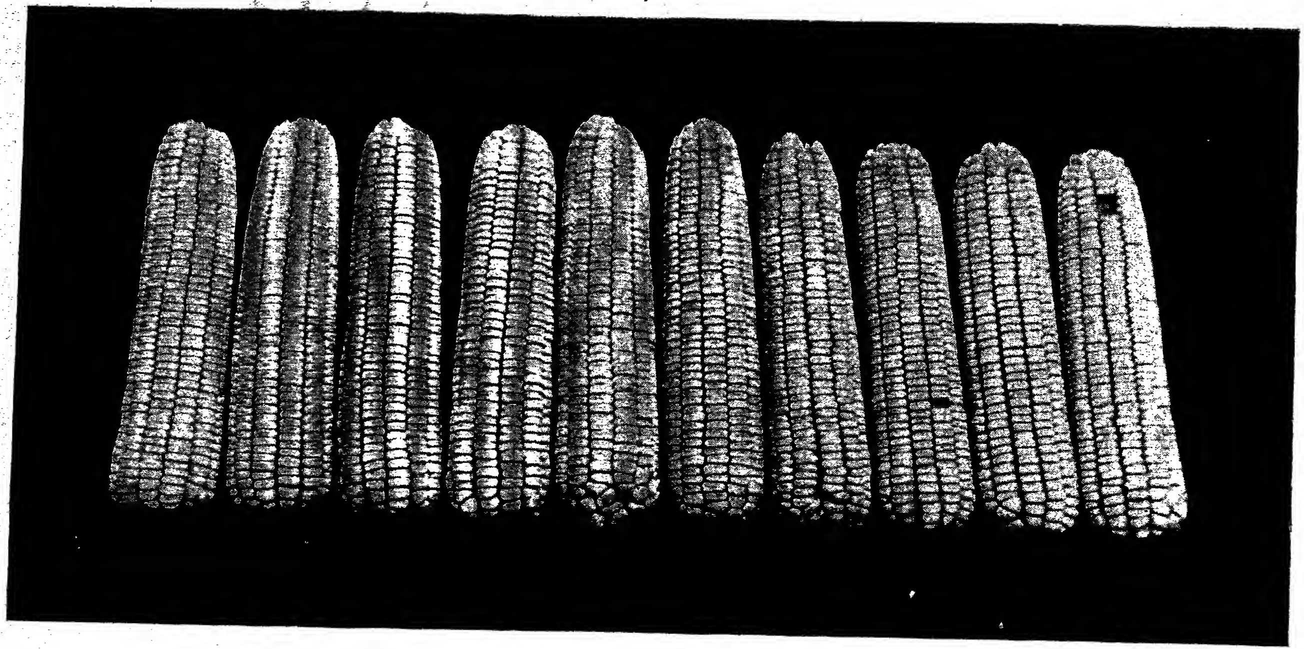

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Editorial.

Contributions and correspondence regarding subjects affecting the farming industry of Southern Rhodesia are invited. All communications regarding these matters and advertisements should be addressed to:—The Editor, Department of Agriculture, Salisbury.

Rothamsted Experimental Station. Annual Report, 1932.—To the question, why continue agricultural research at a time when many farmers cannot sell profitably what they do produce? the answer is to be found in the words of Sir John Russell in this Report: "Scientific investigations in agriculture are primarily for the purpose of obtaining information, and this will always be needed so long as farming continues. It is in times of difficulty that expert information about soils, crops and animals is most valuable to farmers, for it enables them rapidly to alter their methods in accordance with the rapidly changing economic conditions." The work described in the Report shows the type of information that is being gained in order to deal with changes in modern conditions.

Improvements in field experiments through the further application of statistical methods are recorded and illustrated by the results obtained with a number of crops. The value of these methods is that they both reduce the error of the results and make an estimate of the accuracy of the experiment possible. Some of the results—for example, those obtained with sugar-beet—illustrate the need for still more information in every-day farming problems. Why is it that no amount of manuring has overcome the difference in yield between beet crops in adjacent fields, where one field may produce twice as much root as the other? In connection with the manuring of sugar-beet, the value of ordinary agricultural salt has proved unexpectedly high, being no less than that of potash.

Experiments with other crops—potato, fodder mixtures, kale, grassland, wheat and rotations—are described. The inoculation of lucerne, and now of clover, is being closely studied in field and laboratory. The extent to which insect and fungus diseases have infested the two farms, at Rothamsted and at Woburn, is described in detail, and there is a most interesting summary of farm operations for the year in the Farm Director's report.

The work on plant diseases well illustrates the range of problems to be tackled. In a bacterial disease of cotton from the Sudan unusual stages in the life-cycle of the bacteria were found; the genetics of a fungus were studied over many years, and related to the behaviour of natural infections; in virus diseases—those caused by agents too small to be seen under the microscope—further progress is reported. The actual way in which the virus influences the plant and travels about its tissues, and the manner of its carriage by insects, are being elucidated. Insect pests receive special study, notably in relation to the enormous fluctuations in numbers that occur, and an attempt to relate these to weather changes is in progress. Methods of insect control by the use of vegetable products as insecticides continue to be studied. Pyrethrum, a very potent agent which can be grown in this country, offers problems both in cultivation and in the preservation of the toxic principle; those intriguing tropical plants that are used by the natives as fish poisons are often valuable insecticides, but it is important to be able to measure their toxicity readily, and methods for doing this are being compared.

Copies of this Report may be obtained from the Secretary, Rothamsted Experimental Station, Harpenden, Herts., at 2/6 each.

Dairy Industry Control Act, 1931.—This Act was adopted to protect the dairy industry of the Colony from the effects of surplus production and of import of surplusses from neighbouring territories. In 1930 the Union, South-West Africa and other African States were faced with large surpluses of butter and cheese which threatened a collapse of all South African markets. Export of the surplus was imperative, but it was clear that export would have to be subsidised if local values were to be maintained.

The wholesale price of dairy products in Southern Rhodesia necessarily follows the price in neighbouring territories. In previous years, Southern Rhodesia exported largely to the Union and took back quantities of other grades to enable it to maintain continuity of supply to its Northern markets. In these circumstances, prohibition of imports from the Union would not have been in the interests of the dairy industry, even if it had been possible under the Customs Convention.

The Union was not prepared to subsidise the export of its surplus for the benefit of adjoining States. It considered that in the conditions obtaining under the Customs Agreement, the various South African States should be regarded as one economic unit for marketing purposes, and that the various States should all take fair part in adjusting the surplus condition. Southern Rhodesia accepted this principle in order to avoid invasion of its local markets by surplus butter from the Union. The Bechuanaland Protectorate, South-West Africa and Swaziland also fell in with this scheme, and undertook to collect levies from which contributions towards the cost of exporting the surplus butter and cheese could be met.

The Dairy Industry Control Act embodies the arrangement come to. Its effect is:—

(1) Local markets are safeguarded from the subsidised competition in the Union, South-West Africa and other States;

(2) Our Northern markets—which absorb 50 per cent. of our output—are similarly protected;

(3) Internal markets are subsidised and local values maintained by the compulsory and subsidised export of surplus.

These arrangements resulted last year in approximately six million lbs. of butter and 2 million lbs. of cheese being exported from the Union, South-West Africa, Bechuanaland and other participating States, with an average bounty of 5½d. per lb.

If legislation had not been operative whereby the export of this surplus could be subsidised, local prices for butterfat would have dropped to as low as 3d. or 4d. per lb.—this being the return from export, exclusive of the subsidy, which is paid from the levy funds. In return for his penny, therefore, the producer has received sixpence on each lb. of butterfat sold.

Liebig's (Rhodesia) Limited.—Information has been received that the Factory at West Nicholson will shortly be in a position to receive cattle. Stockowners are requested to advise the General Manager, Liebig's (Rhodesia) Limited, Mazunga, what number of cattle they have for disposal. A minimum price of 2/6 per 100 lbs. liveweight will be paid for suitable cattle delivered at factory, and any subsidy which may accrue and be paid by the Government will be for seller's account.

Price of Crown Land Committee's Report.—In April, 1932, Mr. C. S. Jobling moved in the Legislative Assembly "that the House urges upon the Government that it takes into immediate consideration the necessity for a reduction in the price of Crown Land, in order to bring about some correlation between such price and the present values of agricultural and pastorial products." This motion was accepted by the Government, provided that the consideration did not extend to "Empire Settlers," the "British Empire Service League Scheme" or to the payment of quit rent, and a committee was appointed to enquire into the general question of land values in the Colony.

Towards the end of 1932, a report was submitted, the outcome of which was that in March this year a second committee was appointed to enquire into individual cases. An advertisement was inserted in all Rhodesian papers, inviting holders of Crown Land who wished to apply for a reduction, to make application before the 30th April. The committee consisted of:—Dr. C. K. Brain, Director of Agriculture (Chairman); Mr. James Watson, "Kilmuir," Arcturus; Mr. John Grant, "Gilnockie," Arcturus; Mr. Frank Brooks, Department of Lands; and Mr. J. H. Hampton, Department of Lands.

The committee met in April and evidence was taken in Salisbury, Gatooma, Headlands, Inyazura, Gwelo, Fort Victoria, Insiza and Bulawayo. The committee visited farms in the Beatrice, Greystone, Headlands, Tsungwesi, Victoria, Shabani, Insiza and Gatooma areas. Altogether 323 applications were received, but in order to anticipate further applications, it was considered desirable to review every case in which land is at present held from the Government, whether an application was received or not. The report of the committee has been published.

For reasons stated in the report, the committee could not recommend a general reduction in the purchase price of Crown Land, nor the general writing off of outstandings, but recommended that the position would be most suitably met by a revision of interest charges since the date of Responsible Government. The Government has accepted the main recommendations of the committee and it has, therefore, been decided that, provided present holders of Crown Land under Agreement of Purchase, Permits of Occupation, or D.I. terms, are prepared to accept the new terms, no interest will be charged since the 1st October, 1923, and that all payments since that date, on account of either capital or interest, will be credited to capital, provided, of course, they were not made in respect of outstandings prior to Responsible Government. The purchase price under the new terms will be increased by 10 per cent. to cover administrative costs. In future when payment is made in full at the time of purchase no charge for administrative costs will be made. If a farm is once taken up on terms, therefore, and a cash payment is offered later to

take title, no remission of this charge will be granted. If the new terms are accepted, a new Agreement of Purchase will be issued, but the period over which the balance of the purchase price is to be made may be extended if application is made for this to be done.

It has been decided that the above terms shall apply to all Permits of Occupation which are exchanged for Agreements of Purchase within a period of six months from due notice being given. Unless such exchange is made during the stipulated period, no consideration will be given to holders of Permits of Occupation beyond the reduction of the rental from 5 per cent. to 4 per cent. which has already been approved. The conditions to be applied to future Agreements of Purchase are still to be decided.

It is anticipated that under these favourable terms there will be no occasion for farmers to take advantage of the moratorium as advertised previously, since the payments now to be made annually will be little more than the interest due under the moratorium. It would certainly not be to the advantage of the farmer to continue to pay such interest, since it will not be credited to capital. The new terms offered will, therefore, supercede the moratorium in all cases where they are accepted.

The committee recommended that in future more definite and binding restrictions should be imposed in regard to occupation, development, payment, etc., than has applied previously, and that these questions, together with all others concerning land settlement, land alienation, reduction in price, failure to make payments when due, and all allied questions should be dealt with by a Land Board constituted on lines similar to the Land Bank Board. The Government has not yet accepted this recommendation, but the question will be considered in the near future.

It is realised that the increasing burden of outstandings has been the cause of much anxiety during the last few years, and it is believed that the proposals now accepted by the Government will relieve occupiers of Crown Land of this burden and that they will thus be enabled to face the future with greater confidence and hopefulness.

Dealing with Swarms of Flying Locusts.—In the May issue instructions were given for dealing with flying swarms of locusts. It was pointed out that scaring methods, such as the beating of tins, while primitive, are frequently very effective. Instructions were also given for the use of smudge fires and chemical smudges. The Entomological Division now state that various reports received during the dry season indicate that usually flying locusts are prevented from settling on crops or are driven off them quite successfully by scaring methods as described in Bulletin No. 890. However, numerous cases of the failure of these methods are reported. Frequently reports suggest that scaring methods are more successful than smoke fires and chemical smudges.

Further experience with the chemical smudge mixture described in Bulletin No. 890 indicates that about $2\frac{1}{2}$ to 3 lbs. are required in a 2 lb. jam tin if it is to burn for 15 minutes.

Conference of Miners and Farmers.—One of the most important Conferences held in recent times met in Salisbury on Wednesday, October 18th, to discuss amendments to the Mining Law, and to submit recommendations to the Government. The Attorney-General, Mr. A. E. Speight, was in the chair, and the representatives were:—Mining: Rhodesia Mining Federation, Messrs. D. Abrahamson and P. M. Robertson, with Mr. V. S. Welsford as adviser; Salisbury Chamber of Mines, Sir Ernest Montagu, with Mr. D. V. Burnett as adviser; Bulawayo Chamber of Mines, Mr. B. W. Durham, with Mr. R. E. W. Hughes as adviser. Agriculture: Rhodesia Agricultural Union, Mr. A. M. Hutchinson, with the Hon. J. S. Parker as adviser; Matabeleland Agricultural Union, Mr. F. E. Goodridge; Midlands Farmers' Agricultural Union, Mr. A. B. Shepherd Cross, with Mr. J. D. Swan as adviser; Eastern Districts Farmers' Federation, Mr. Estcourt Palmer.

The Conference was opened by the Minister of Mines (the Hon. W. S. Senior) and the Minister of Agriculture (the Hon. C. S. Jobling). Both Ministers emphasised the fact that the Conference had been called to make united recommendations to the new Government regarding the best means of dealing with amendments to the Mining Law, and both

indicated that a great deal would depend upon the spirit in which the task was undertaken. It will give great satisfaction to learn that the Conference maintained throughout a very fine spirit of compromise, and that the results achieved are likely to go a very long way towards meeting a most difficult situation.

Export of Chilled Beef.—Dr. A. E. Romyn has recently returned from a trip to England, where he spent several weeks enquiring into all the different aspects of the chilled meat trade. Elsewhere in this issue some notes appear which are of particular interest. It is clear that a very good start has been made, and in August last the Rhodesian shipments represented no less than 4 per cent. of the total amount imported into Great Britain during that month. Since the first shipments were made it is interesting to note that the authorities in Great Britain state that there has been a progressive improvement in the handling of the meat. The prices have on the whole been unsatisfactory, but this is probably due to the fact that owing to the hot summer, meat prices in general have been on the low side. Dr. Romyn emphasises that the beef at present is finding its outlet in a poor class of trade where cheapness, not quality, is the main consideration, and that to secure better prices it will be necessary to improve the average quality of the beef exported.

The chief criticism of the meat exported is the lack of fat covering described in the trade as lack of quality. The quickest way to achieve the improvement required is by supplementary feeding. Propaganda for more feeding is active at the moment, and it is hoped that a considerable number of "stall fed" bullocks will be exported in the coming year. The economics of the system should, therefore, get a thorough test. At the same time it must, however, be emphasised that the system will not get a fair trial unless a reasonable proportion of the profit from the individual efforts is returned direct to the feeder and not absorbed in the general bulk of the trade. To ensure this it will probably be necessary to introduce a system of grading and payment on quality, and the question of grading should be considered by producers before the trade is much older.

Maize Growers' Successes at World's Grain Exhibition.—It is with pleasure that we record the achievements of those four enterprising maize growers whose exhibits competed so successfully against all breeds of maize at the World's Grain Exhibition, Canada, in July last. From the standpoint of publicity the Rhodesian exhibits have proved an unqualified success, but if further results are to be achieved it will be necessary for the maize growers of this Colony to follow up the interest already aroused by making every endeavour to ensure representation on a much greater scale at future exhibitions.

A further interesting aspect of this Colony's participation will be the opportunity afforded of comparing the basis of the judging of the four exhibits by the exhibition authorities as compared with the system employed locally.

The official report of the judges has not yet been received, but it is proposed to publish it in the Journal at an early date, and it is hoped that it will afford the maize judges in this country an opportunity of formulating a suitable score card which may bring the system of judging in this Colony into line with that employed by the leading international judges of the principal maize growing countries of the world.

It is understood that great stress was laid by the judges on the germination capacity of the exhibits, and it will be interesting to see whether the stringent fumigation which our exhibits necessarily underwent seriously depreciated their show value in this regard.

We wish to extend our congratulations to the successful exhibitors who are mentioned below, together with the prizes won by them. The photographs on the following pages illustrate the exhibits which competed at the exhibition.

The Hon. H. Gibbs, Bulawayo: Potchefstroom Pearl, 22nd Prize.

G. H. Cautherley, Esq., Eldorado: Salisbury White, 25th Prize.

J. A. Rennie, Esq., Fort Victoria: Salisbury White, 26th Prize.

The British South Africa Company's Mazoe Estate: Hickory King, 27th Prize.

Dairy Production.—The report of the Statistical Bureau for October 7th, states:—

Butter.—The slump in butter production continues, the total for the month of August, 1933, only amounting to 26,010 lbs. compared with 28,865 lbs. in July, 1933, and 41,529 lbs. in August, 1932.

Imports were negligible and exports, though more than double those for the previous month, only totalled 36,003 lbs. compared with 106,676 lbs. in August, 1932. Stocks in hand at the end of August amounted to 299,889 lbs. compared with 431,191 lbs. at the end of August, 1932.

Butter-fat prices continued at the same level as that reached at the end of July, *i.e.*, Grade I., 16d.; Grade II., 13d.; and Grade III., 12d. per lb. Wholesale prices of butter remained unchanged at about 1d. per lb. more than the average for July, 1933.

Cheese.—The production of cheese, like butter, continues to drop. The production in August, 1933, amounted to 10,421 lbs. compared with 14,612 lbs. in July, 1933, and 12,060 lbs. in August, 1932.

During the eight months, January-August, 1933, imports of cheese amounted to 27,691 lbs. and exports 55,769 lbs. compared with 67,951 lbs. and 43,037 lbs. respectively for the corresponding period of 1932.

Stocks on hand at the end of August, 1933, totalled 65,395 lbs. as against a total of 114,709 lbs. at the same date in 1932.

Tobacco Growers' Conference.—At the invitation of the Minister of Agriculture a very large gathering met in the Duthie Hall, Salisbury, on October 24th, to discuss the formation of a central organisation of Tobacco Growers which is truly representative of the whole of the growers' interests. The chair was taken by the President of the Rhodesia Agricultural Union, Mr. G. N. Fleming, and the object of calling the meeting was clearly explained by the Minister of Agriculture. A series of resolutions, prepared by the President of

the Rhodesia Tobacco Association, Major L. M. Hastings, M.P., had been previously circulated, and these were submitted to the Conference for discussion. The first step was to ensure that a fully representative association was formed which would include every grower in the Colony, and this was accomplished by adopting the following resolution:—

"This meeting of tobacco growers forms itself into one representative organisation to be known as the Rhodesia Tobacco Association, of which all tobacco growers contributing to the Tobacco Levy Fund shall automatically become members; the affairs of the Association shall be governed by a central council, which shall be elected on the principle of territorial representation, and that steps be taken to elect district representatives as soon as possible."

The next resolution recommended that the central council should administer the levy funds and deal with the affairs of the tobacco industry as a whole with the addition of a chairman and two vice-presidents.

It was agreed that the principal officials should be tobacco growers and that they should be elected by the central council from their own members. The resolution was carried.

The third resolution was that for the first year the Government be asked to demarcate the areas from which the representatives were to be appointed, "bearing in mind the principle of approximate equality in the numbers of growers in each district, as far as possible, and that growers of fire-cured and Turkish tobacco, and all other types, should have adequate representation. It was further agreed that the Government, with the assistance of the central council, should demarcate the areas from year to year.

The fourth resolution that some contribution be made out of levy funds towards the expenses of members of the council in attending meetings was carried unanimously.

The Export of Chilled Beef to the United Kingdom.

By Dr. A. E. Romyn, Senior Animal Husbandry Officer.

We are in a position now to review the results of the first five months of the export of chilled beef to the United Kingdom.

On the whole the grass fed beef exported has proved too lean for the market requirements.

It is necessary to make this clear at the outset as the opinion is generally held in the Colony that, since the English market requires small lean beef, Rhodesian cattle should meet this requirement well. It is true that the market tendency is towards smaller joints and leaner beef, but the English standard for lean beef is very different from the South African. The ordinary "Super-prime" of the local market is not too fat for the English trade.

This aspect of the question has been lost sight of in the rapid expansion of the first five months. The development of the trade from nothing to, in August last, four per cent. of the total chilled beef imports of the United Kingdom is an achievement which reflects credit on all concerned. Exporters have sent the best cattle available, but to secure a firm footing in the market, it seems that it will be necessary to improve a good deal on the average quality of the beef shipped.

The chief criticism of Rhodesian beef is lack of quality, and a dry season has tended to emphasise this deficiency. The forequarters are especially faulted for lack of covering.

"Quality" is understood to mean an even covering of fat over the whole carcase with no bare patches over the loins, crops and rounds, and a reasonably good distribution of internal fat. The bone should be comparatively light and the side evenly proportioned.

Rhodesian meat is generally so deficient in quality when judged from ordinary chilled meat standards that butchering and condition, usually important points, are largely overlooked by the buyers and fat sides sell the best at present irrespective, to a certain extent, of age and the finer points of preparation.

To-day Rhodesian beef has found its way mostly into the cheapest kind of retail trade. A certain amount is purchased for contracts stipulating chilled meat. Some is used by manufacturers of pies, potted meats, etc. Within this circle of usage the meat is popular. It cuts up remarkably well and compares well with the Brazilian chilled and Australian frozen meat with which it is generally sold in competition. In this trade, however, cheapness, not quality, is the prime consideration and, to get better prices and to widen the demand for Rhodesian beef, it will be essential to improve the average quality of the meat shipped.

In this respect *feed* will play a more important part to start with than breeding. A consignment of chilled meat from the Union of South Africa and another from Australia which arrived in England recently will illustrate this point very well. Both consignments in respect of the shape of the quarters and age were comparable with the Rhodesian meat on sale at the time. The butchering of all lots was similar. The condition of the Rhodesian beef was the best of the three, yet the other consignments sold at approximately 1d. per lb. more for sides. The difference in price was almost entirely due to quality or fat covering, which in *each case, was the result of better feeding.*

Except for a brief period in the summer it looks, from this year's results, as if the best grass feds will not carry sufficient finish for the English market and that they will not, it any case, in an ordinary season, be fat enough for export until five years of age or older. A varying period of supplementary feeling will be necessary to get the finish required, and it should be the deliberate policy of exporters in this Colony to feed an increasing percentage of cattle for export year by year until possibly seventy-five per cent. of the cattle exported receive sufficient supplementary feeding to ensure a reasonable covering of fat inside and out before they are slaughtered.

To go further, I feel that *three or four months of supplementary feeding would have enhanced the value of the average beef shipped this season by not less than* $\frac{3}{4}$*d. to* 1*d. per lb.* The prices realised for the recent exports of stall fed cattle tend to confirm this view.

Apart from the immediate improvement in quality which results, supplementary feeding has other advantages which it is not necessary to enlarge on here. Applied to younger cattle it will increase the rate of maturity and improve their conformation. Much of the "legginess" which is apparent now in the average quarter exported will be overcome. Better feeding of the young stock, especially the weaners, will justify the use of better bulls and so gradually raise the whole standard of the cattle industry.

Feeding will not, however, become a general practice until it can be shown to pay, and until the feeder is sure that a fair share of the profits from his individual efforts, either in the direction of feeding or better general management, will be returned to him and not absorbed in the general bulk of the meat exported.

Propaganda for feeding is active at the moment, and it is hoped to export a considerable number of "stall fed" bullocks in the coming year. The economics of the system should, therefore, get a good trial. A factor, however, which militates against the full return going to the producer of the best grass feds or "stall fed" cattle is the lack of grading. The meat is not graded, other than for weight, and the good to a certain extent sells the bad. Producers should at this stage, before the trade "gets set," seriously consider the introduction of a system of grading on quality and of payment by grade. Other meat exporting countries have found it necessary to grade chilled and frozen beef, and the same need will arise here as soon as efforts are made to improve the quality of the cattle raised.

The Cultivation of Palms
IN SOUTHERN RHODESIA.

By Major W. J. Phillips, O.B.E., F.R.H.S.

It has been proved beyond question that palms can be successfully cultivated in the open in this Colony. These tropical and sub-tropical plants permanently improve the appearance of our gardens, and need little attention when established.

Deep cultivation is essential as the roots penetrate to a considerable depth in search of moisture. The ground should be prepared by digging holes at least five feet wide and five feet deep. Care should be taken to keep the sub-soil apart from the surface soil and to return only surface soil.

When filling in the holes a quantity of vegetable matter, garden refuse, leaves, etc., should be buried at the bottom, this will decay and provide a reserve of plant food for all time.

Well rotted manure and bonemeal should be incorporated with the surface soil, which should be approximately nine inches above the level of the surrounding ground to allow for settling. Planting may be done at any time, but preferably during August and September, when root growth is active. Well established plants only should be used, these should be set at ground level, mulched into well rotted manure and given a good watering once a week until the rains set in and they become established.

About the middle of March in each year give the surface a thorough cultivating and put on a mulch of well rotted manure or leaves; this will conserve the moisture and enable the plants to stand through the dry season without detriment. During the autumn and winter months the older fronds will die, these should be allowed to remain until the palms are in active growth after our first rains and then removed.

Palms may be planted as isolated specimens, in groups, or to form avenues; in the latter case they should be spaced twenty feet apart each way. Avenues may be straight or curved and should be planted with one kind of palm only, for this purpose *Cocos plumosa* is superior to all others.

The following species are also suitable:—

Corypha australis.
Seaforthia elegans.
Caryota urens.
Washingtonia robusta.
Phoenix senegalensis.
Phoenix sylvestris.
Phoenix tenuis.

In addition to the foregoing, the following are suitable for groups or as isolated specimens:—

Chamærops excelsa.
Chamærops Fortunei.
Chamærops elegans.
Sabal Palmetto.
Latania borbonica.

The last named must be planted in a shady situation.

Groups may be of any shape desired, but are more effective when oblong or round and can also be planted with the stronger growing Dracænas, *Phormium tenax variegatum*, *Cycas revoluta* and *Encephalartos.*

In forming groups the various plants should be set six feet apart. Bamboos should not be planted in these groups unless special precautions are taken to prevent their spreading to the detriment of their neighbours. These foliage plants are most attractive in a garden and a perpetual source of interest, their beauty increasing year by year.

Foliage group six years after planting.

Report of the Division of Plant Industry

FOR THE YEAR 1932.

By H. G. MUNDY, Dip. Agric. (Wye), F.L.S.

Further curtailment of the activities of the Division for reasons of economy, have unfortunately to be recorded. Operations on the remaining portion of the Gwebi farm were suspended after harvesting was completed; livestock and implements were sold and the section was leased to a prominent farmer, who may be expected to maintain the property at as high a standard as can be looked for under the circumstances. Keen demand was evinced for the pedigree Large White and Large Black pigs, and the dispersal throughout the Territory of these animals—the progeny of recent importations from England—should not be without benefit to the industry. Less interest was evinced in the pedigree beef Shorthorn herd, numbering 26 head, the nucleus of which, representing some of the best blood in Great Britain, was imported in 1928. It is a satisfaction, however, that the animals were mostly bought by well-known breeders in whose hands they should continue to exert an improving effect on the beef stock of the Colony.

The Gwebi farm had been maintained as a Government Experiment and Demonstration Station for twenty years, and during that time has pioneered and demonstrated on a large scale many of the practices such as fattening for beef, hand-rearing of dairy calves, green manuring, the use of fertilisers on farm crops, the growing of oats as a summer crop and the making of veld hay in large amounts and so forth, which to-day are adopted as a matter of course by progressive farmers. Its closure has occasioned wide regret.

A further measure of economy deemed necessary was the closing down of the Botanical Branch at the end of October. Though its reconstituted life has been short, valuable work has been done by Miss S. M. Stent, Senior Botanist, and Mr.

R. M. Rattray, Botanist, and though still far from fully representative of the flora of the Colony, a useful herbarium has been built up.

Maize.—A favourable season combined with the better methods of farming now generally followed, resulted in a much larger crop than was anticipated. The area planted has been reduced by 75,000 acres since the year of maximum acreage, *viz.*, 1928-29, yet the present season's production is (according to provisional figures supplied by the Government Statistician, which however are not likely to be materially amended) the third highest in the history of the Colony, namely, 1,784,243 bags from 250,108 acres, or an average of 7.1 bags an acre—a record for Rhodesia. The next best average yield to this was 6.80 bags per acre in 1922-23.

The Mazoe district produced an average of 9 bags per acre as compared with a previous ten years' average of 7 bags an acre, and the corresponding figures for the Salisbury and Hartley districts respectively, were 9.2 bags compared with 5.7 bags, and 7.8 bags compared with 4.6 bags per acre. The only district in the Colony to show a substantial decrease in yield is Lomagundi with 4.9 bags an acre for the past season as compared with 7.4 bags in 1920-21, and 7 bags in 1926-27, since when the return has been steadily falling.

It is particularly to be regretted that the praiseworthy efforts of farmers to reduce the total area under maize and simultaneously increase the yield per acre—thereby lowering costs of production—should synchronise with even lower overseas prices than last year. The poor financial return likely to be obtained will, it is feared, react unfavourably on the amount of fertiliser applied during the coming season, with detriment to the arable land on many farms.

Wheat.—The wheat crop is believed to have constituted a record in the history of the Colony due in part to better methods, including the more liberal use of fertilisers and the employment of the drill in seeding operations, and in part to the late rains which fell in autumn. Experience has shown that dry-land or vlei wheat responds in an exceptional manner to even light dressings of phosphatic fertiliser. Farm manure still remains the most effective manurial treatment,

but provided a sufficiency of organic matter is maintained in the soil the application of 100-200 lbs. of phosphatic fertiliser per acre materially and economically increases the yield. An added improvement is secured by light applications of nitrogen, in the form of sulphate of ammonia, at the time of seeding. Further evidence of the value of applications of lime to wheat lands has been secured.

As will be seen by reference to the report of Mr. Sansom, the Plant Breeder, encouraging progress has been made in the improvement of wheat varieties, and in the case of some strains, "strength" as indicated by protein content, has been improved by 2½ to 3 per cent. in three season's work.

Ground Nuts.—The acreage planted to ground nuts by European farmers and the output, was the smallest for many years, but it is satisfactory to note that the average acre yield of 10 bags is the highest recorded in the history of the country.

Further efforts have been made by local firms to develop the ground nut industry, and considerable activity has been evident in the export of oil and graded nuts in the shell—the latter to Great Britain, where in the early part of the season a good demand at remunerative prices was experienced. Latterly values have fallen, but it is to be hoped that the duties imposed on foreign nuts entering Great Britain and Canada as the result of the Ottawa Agreements, may prove of assistance to Rhodesia in further expanding this industry for which soil and climatic conditions are so favourable. The average yield can still be increased materially, at small additional cost, by the adoption of better cultural methods and greater care in planting and harvesting.

Co-operative experiments with a little-known variety of nut which may meet a special demand on the Home market, are in progress.

Green Manuring.—The acreage planted to green manure crops, *viz.*, 50,900 acres, establishes yet another record and represents rather more than one-fifth of the area planted to maize. During the past two years 100,000 acres of arable land have been green manured and there can be no doubt that to this fact is largely attributed the increase in maize yield recorded in an earlier paragraph.

Of this 50,000 odd acres, 41,200 acres were sown to legumes, principally sunn hemp, compared with approximately half legumes and half non-legumes in 1930-31.

The more abundant supplies and lower price of sunn hemp seed have largely been responsible for the increased use of this crop as a green manure, but there is still great need for the development of heavier yielding strains so that the cost of seed may be still further reduced.

The value of green manuring as a means of increasing subsequent crop yields in this Colony is now fully recognised by all well informed farmers, and there can be no doubt that the ceaseless advocacy of the practice over the last ten years by the Division of Plant Industry has at last borne generous fruit.

Witch Weed.—Public opinion seems at last to have been stirred to the danger of the encroachment of this pest into arable land, and considerable attention is being given to the subject in those districts where it has made its appearance. The system of trap-cropping as a means towards eradication is being more generally adopted, and spraying with sodium chloride is being continued in the Mazoe Valley and should yield definitely informative results next year. A number of farmers are experimenting with Sudan grass and kaffir corn varieties, with a view to producing seed for their own trap-cropping and for sale, and the Division has introduced and distributed seed of Early Amber cane (*sorghum*) for comparative trial as a trap-crop with Sudan grass and white kaffir corns.

The ploughing under of two immature trap-crops of Sudan grass in the season has been shown on the Salisbury Experiment Station to be almost as effective in restoring soil fertility as the ploughing under of one crop of sunn hemp. This is a point of far-reaching importance, since it infers that the eradication of witch weed can be combined with an improvement in soil fertility.

Grass and Pasture Investigations.—Experiments commenced two years ago on the Research Farm, Marandellas, with the object of ascertaining the most suitable grasses and legumes for improved pastures on vlei soils, unaided by irriga-

tion, have yielded valuable information. Of the exotics, Yorkshire Fog, *Paspalum dilatatum*, and *Upright paspalum* are outstanding. The former has survived for two years and appears fully capable of holding its own. It has remained green and made considerable growth throughout both winters and the free manner in which it is grazed testifies to its palatability. Other exotics which have survived and for which, given fuller knowledge, these vleis may perhaps be made suitable are *Phalaris bulbosa* and *P. tuberosa*, Cocksfoot, Tall fescue, Tall Oat grass and Sweet Vernal. Kikuyu grass has spread rapidly, but demands a higher standard of fertility than is normally afforded by this type of land, and it can only be recommended with the reservation that to prove useful it must receive liberal and frequent applications of artificial fertilisers. Of the legumes, White clover gives the greatest promise, followed by Alsike and Giant cowgrass.

Among indigenous grasses, Swamp couch (*Hæmarthria fasiculata*) and Wild paspalum *P. scrobiculatum*, are without equal for vlei land, and their wide establishment can now be safely recommended. Swamp couch and White clover in combination appear particularly happy.

Progress has been made on the Salisbury Experiment Station in the establishment of improved pastures on upland soils, and an interim report on the subject was recently published in the Journal. On this class of land indigenous African species remain unchallenged, and there need now be no hesitation in recommending the extensive establishment of at least two species, namely, Woolly Finger grass and Creeping False Paspalum *Brachiaria dictyoneura*. The latter very quickly covers the land with a dense turf, and though subject to a leaf-spot during the rainy season, this does not seem materially to reduce its palatability. Hunyani grass, a type of Rhodes grass (*Chloris gayana*) and Rhodes grass itself, also show much promise, while *Urochloa pululans* and *U. bulbodes*, together with strains of *Panicum maximum*, should also be valuable if proved sufficiently tolerant of close grazing.

The grass land experiments conducted by the African Explosives and Industries, Limited, in co-operation with this Department and a number of local farmers, have already

yielded valuable information, and perhaps are of even greater account by reason of the attention they have focussed on the need for better methods of grassland management.

There are in the Colony a total of 485 acres divided into small paddocks, on which the effect of various applications of artificial fertilisers are being observed. The response to double dressings of nitrogen and to phosphates is notable throughout the experiments and the highest response is almost invariably found where complete artificials are applied.

Grass Silage.—As foreshadowed in my last report, numerous experiments were made during the year in the making of veld grass silages, in stacks and in pits. The stack silage was generally unsuccessful, due, it would seem, to the grass being insufficiently succulent and to temperatures rising too high even when large additions were made to the stack each day. Veld grass silage conserved in pits, on the other hand, was universally successful and yielded an attractive and palatable fodder.

Stack silage possesses advantages over pit silage in respect to economy in making and feeding, and it is desirable that further investigations should be conducted with a view to ascertaining the exact causes which led to so many failures during the past season.

Preliminary experiments were carried out in the making of low-temperature silage by treating fodders with solutions of molasses with a view to reducing losses in feed value during fermentation. It is hoped to extend these investigations during the coming season and also to conduct some work on the A.I.V. system of silage making.

Soya Bean.—An advance has been made on the Salisbury Experiment Station in the development of non-shattering strains of soya bean, but it has not yet been possible to combine this characteristic with a maximum yield of grain. It is hoped to achieve this by further crossings to be undertaken during the coming season. Meanwhile, non-shattering strains from the Union of South Africa are being compared with our own selections. On most soils successful production of the soya bean crop depends upon satisfactory inoculation by means of bacterial culture. The Plant Patholo-

gist and the Plant Breeder are co-operating in an investigation into this subject and should be in a position to report fully on the matter at the close of the coming season. On rich soils, or those heavily dressed with farm manure, inoculation is not usually so essential, but be that is it may, it is satisfactory to record that an inexpensive bacterial culture which has proved eminently effective in Rhodesia, is now obtainable in South Africa.

Sunn Hemp.—Efforts to improve the seed yield of this crop have been in a measure rewarded, and small amounts of improved seed have been issued to a limited number of farmers for further trial. The work is proceeding.

Madagascar Butter Bean.—Seed of this crop has been introduced and issued to ten farmers located in the warmer areas who have irrigated land, with a view to attempting the production of this bean for export to Great Britain, where it appears to be in greater favour than any other type.

Enkeldoorn Demonstration Station.—This station consists of 26 acres of poor upland, sandy soil on Belvoir Spinney, owned by Mr. P. Brocklehurst, the land being of the type normally regarded in the Charter district as practically useless for crop production. The demonstrations have been in progress for four years, but the first season's results were a virtual failure, due to the late date at which the land was broken up, inadequate preparation of the seed-bed and an abnormally heavy rainfall. Four practical crop rotation systems are demonstrated, and in addition to maize a variety of cash and fodder crops are grown. The plots are sufficiently large to allow of sowings being made by machine and the land receives no more favoured treatment than may reasonably be looked for on a well managed farm.

The systems of cropping which are followed comprise (*a*) maize continuous with 150 lbs. per acre of fertiliser every other year, (*b*) one green manuring with sunn hemp followed by three crops of maize, the first and third receiving fertiliser, (*c*) one year of fertilised maize followed by sweet potatoes and edible canna, then by doliches beans for hay and finally by oats and Sudan grass for hay, both the latter with fertiliser, (*d*) Sunn hemp ploughed under followed by maize with ferti-

liser followed by sweet potatoes followed by beans for hay, and (*e*) maize with five loads of farm manure per acre followed by maize with fertiliser, followed by cow peas for grain, followed by sunflower and ground nuts.

The measure to which such land can be profitably utilised for crop production and the extent to which fertility can be increased by judicious management, is exemplified by the fact that the average annual maize yield over the 14 acres planted each year to this crop shows a steady rise from 8.46 bags per acre in 1929-30 to 9.72 bags in 1930-31 and 10.87 bags per acre in 1931-32. The highest yields obtained over the three seasons were, on series (*b*) 14 bags per acre in 1930-31 followed by 13 bags an acre in 1931-32, and 15 bags an acre in 1931-32 on series (*e*). The yields of other crops have been equally satisfactory with the exception of ground nuts and sunflower, which for some unexplained reason have not proved successful on this farm.

Farmers of the locality have not shown the interest in the station which it was hoped they would do, but Mr. Brocklehurst states that the demonstrations have been of material value to him, for from an average of 4-5 bags of maize an acre, the yield on his own fields which are situated on somewhat better soil, was increased last season to 13 bags an acre; the work has likewise demonstrated of what these upland granite soils in the Charter district are capable when suitably farmed.

Tobacco.—Taking the Colony as a whole, the year may be said to have been a fairly successful one for tobacco growers. The season opened well and early plantings produced leaf of good quality. But the heavy and continuous rains late in the season hampered curing and led to reduction in both the output and quality of the later planted crop. Not a little damage was caused by the disease "Leaf Curl," the occurrence of which was reported from several areas late in 1931. The remedial measures at once recommended by the Department checked the spread of this trouble, but not before appreciable harm had been done. It would appear from present reports, that the areas in which adequate control measures were immediately adopted last season are virtually free of the disease this year. Difficulty has, however, been experienced with

abandoned tobacco farms and lands on which in early spring volunteer plants were found actively infected with "White Fly" and "Leaf Curl." Means are being considered to control the danger arising from "stand-over" and volunteer crops by legislative enactment. Further investigations into the host plants of White Fly, and control measures are being jointly undertaken by the Entomological Officers and the Plant Pathologist.

Information, as yet inconclusive, but promising to be of material value, has been obtained from the investigations on the Tobacco Research Station of the effect on the burning quality of the leaf of applications of chlorine to the growing crop.

The following are some of the more important points dealt with in the report of the Chief Tobacco Officer:—

"The work of the Tobacco Branch has been conducted on a restricted scale owing to financial stringency and also to retrenchment in the staff. The present staff comprises four members, three of whom are stationed on the Tobacco Research Station. In addition to tobacco plant breeding work, the services of the Plant Breeder are also engaged on similar work with certain other crops.

"The late rains did considerable damage to late planted Virginia and to Turkish tobacco; Dark Fire cured tobacco also suffered in quality. Wireworm and cutworms were active in many centres. Mosaic disease was fairly prevalent. The incidence of this disease is gradually being reduced by an increasing number of tobacco growers adopting suitable control measures.

"Unsuitable climatic conditions towards the conclusion of the season were responsible for a greater incidence in "Barn Spot" or "Frogeye," thus causing an appreciable reduction in the yield and the quality of the tobacco cured during the latter half of the season. "Angular Leaf Spot" and "Wildfire"—diseases which in the past have taken a heavy toll—were not very prevalent this year. Speaking generally, the crop was of better quality than that harvested last season.

"The main object of work at the Tobacco Research Station, as arranged at present, is towards effecting improvement in the quality of the crop. Many important investigations have of necessity been postponed until such time as more adequate financial provision becomes available.

"The seasonal conditions were such that there appeared to be no appreciable difference in the growth of tobacco receiving a heavy dressing of chemical fertiliser and that which was grown on lighter applications. The inclusion of potash in the form of Muriate of Potash in the fertiliser mixture, had the effect of reducing the degree of damage occurring through disease.

"Experiments to determine the effect of applications of chlorine in the form of Muriate of Potash and of common salt on the quality and chemical composition of the tobacco were conducted with a view to reducing the rate of combustion of Southern Rhodesia tobacco, the overseas market requirements being for a slower burning leaf than is at present produced generally in this Colony.

"In connection with tobacco plant breeding, selections were made in each of a number of varieties with a view to securing further selections and the development of suitable strains for distribution to growers. A study of improved cultural methods was also conducted.

"In response to requests made by Farmers' Associations, a series of varietal trials were conducted on several farms in each of the following districts:—Mazoe, Lomagundi, Hartley, Salisbury, Marandellas and Makoni. The plots were visited at intervals throughout the growing season and were used for practical demonstration purposes on occasions when neighbouring tobacco growers were able to attend. In several instances the plots were severely damaged by Root gall worm, others by wind and hail and one by "Leaf Curl." The value of these experiments was vitiated owing to the fact that practically all of the plots were affected by the abnormally heavy rains occurring late in the season. It was unfortunate also that a record of the final yields of tobacco harvested and cured off each plot was not kept by the majority of those tobacco growers who conducted the experiments.

"*Marketing.*—A further improvement on that recorded last year in regard to the marketing of Southern Rhodesian tobacco in the United Kingdom has been registered during 1932."

Horticulture.—The essential export of citrus fruit slightly exceeded that of previous years, the figures being—1932, 159,248 cases; 1931, 155,449 cases.

Greater use was made of the port of Beira and 74,638 cases were shipped thence as against 53,167 cases in 1931. Exports by destination were as follows:—Canada, 2,875 cases; Sudan, 439 cases; France, 3,114 cases; Near East, 150 cases; India and Far East, 1,020 cases; Java, 50 cases and the balance to the United Kingdom.

Early shipments of oranges and grape fruits realised high prices, but values unfortunately slumped sharply during the period when most of the Valencia exports were being made.

Deciduous Fruits.—The principal deciduous fruit zone, comprising the Rusape-Inyanga area, experienced severe frosts shortly after the blossoming of the apple orchards and the crop for this season is estimated to amount to only about 20 per cent. of the normal.

Proposals are on foot for small trial shipments of Granadillas to the Home market during the coming year.

The Horticulturist in his report comments on the following points of interest:—

"*Fruit Introductions.*—Of new fruits introduced, the Mangosteen and Rambutan from Singapore have not adapted themselves to this climate, having failed to survive the winter months. The four varieties of English Gooseberries received through the kind assistance of Sir Daniel Hall, have failed to make satisfactory growth, either in Salisbury or at Inyanga, at 6,000 feet altitude.

"Two varieties of Pomegranate (one seedless) recently received by air mail from the Royal Botanic Gardens, Kew, have been planted in pots pending distribution, and are making satisfactory growth.

"Many of the attempts to establish Pecan nuts have prove unsatisfactory owing to the susceptability of the young trees to white ant injury. It would appear that in further plantings, special precautions must be taken to guard against this danger.

"*Fruit and Vegetable By-Products.*—It is gratifying to record a general advancement in the production of these commodities. The orange oil industry appears firmly established in the Mazoe Valley, and several small factories are now producing jams, fruit-juices, and jellies. A small plant for the production of canned fruit is being installed in the vicinity of Salisbury. The cans to be used will be the flattened ones now manufactured in Great Britain; these are re-formed locally and if proved satisfactory should aid materially in advancing a promising industry.

"*Garden Flowers.*—A matter of interest is the extended growing of temperate climate bulbs as winter and spring flowers in Rhodesia. Marked success has attended introductions of Daffodils (Narcissus), Hyacinths and Cyclamens, and there can be little doubt that the growing of these flowers, both in pots and in the open ground, will quickly gain in popularity."

Plant Pathology.—The Plant Pathologist was absent on vacation leave for six months of the year, and during that period the Laboratory was closed down. The following extracts from this Officer's annual report are quoted:—

"*Tobacco.*—The outstanding feature of the year was the widespread occurrence of fungus leaf spots at the end of the season, following unusually prolonged rains. Frog Eye was responsible for heavy losses, particularly in the barns, where the black spotting ruined much saleable leaf of good quality.

"Very late in the season outbreaks of Shot Hole and Leaf Blotch (*Phyllosticta* spp.) were reported from numerous districts where the disease behaved in a manner similar to Wildfire, sweeping through and destroying blocks of as much as 20 acres in a few days. The identities of the fungi are not certain, and it is possible that a species distinct from the well known *Phyllosticta tabaci* and *Phyllosticta nicotiana* may be concerned.

"Both Frog Eye, Shot Hole and Leaf Blotch occur in seed-beds, and there is little doubt that the early spotting was overlooked by growers, the serious nature of these diseases not being realised until too late. Experience has shown that both can be controlled by early and regular priming in the lands, combined with efficient spraying of seed-beds and thorough cleaning up of old tobacco trash and plants from the previous season.

"Angular Spot and Wildfire caused damage where they appeared, but their occurrence was not widespread. White Mould (Mildew) has also been reduced owing to higher priming of leaves by the majority of growers. A marked reduction in the amount of Mosaic in all districts was noticed.

"As a result of serious epidemics of Leaf Curl reported from several districts at the beginning of the year Dr. Storey, of the East African Agricultural Research Station, Amani, was invited to visit the Colony in order to investigate the disease. He confirmed the presence of a virus which is transmitted by White Flies, his report being published in the *Agricultural Journal*.

"*Maize.*—Favourable reports having been received from those farmers who have used Tillantin R as a seed dressing consistently during the past few years, as a preventative of Diplodia.

"*Research.*—Successful transmission of the tobacco leaf curl virus from diseases to healthy tobacco by means of white flies was accomplished in the laboratory in co-operation with the Entomological branch. Attempts to establish the identity of suspected leaf curl in *Vernonia* spp. and *Ageratum* sp. were abortive. Infection of tobacco plants with cultures of *Alternaria* from Nyasaland, demonstrated the identity of the Brown Spot disease in the two Colonies. Observations on the hibernation of the fungus are still in progress. Treatment of seed cotton against Angular Spot (*B. malvacearum*) gave complete control with Abavit B and partial control with (*a*) Ceresan (Granosan), (*b*) Sulphuric acid, as compared with full infection in the untreated plots. Similar control of fungus leaf spots was not obtained by these treatments.

"*Herbarium.*—Four hundred and forty-four parcels of material, about half of which were of diseased tobacco, were received for diagnosis and advice in respect to treatment of infected crops. Amongst other diseases a considerable collection was made of rusts and smuts, the majority of which it was possible to determine in the laboratory. The remainder have been sent to Kew to be named. One hundred and one diseases were recorded for the first time in the country, and 338 specimens were added to the herbarium.

Extracts from Report of the Plant Breeder.—"Generally speaking a successful season may be recorded, but certain of the investigations require several years more of repetition before definite conclusions can be reached.

"*Tobacco.*—The work on this crop comprised isolation and selection of strains of the following twelve varieties:—Cash, Gold Leaf, Yellow Prior, Hickory Prior (local seed), Hickory Prior (imported seed), White Stem Orinoco (local seed), White Stem Orinoco (imported seed), Warne, Jamaica Wrapper, Willow Leaf, Hester and Gold Finder. Selection in the field was chiefly based on the following points—(*a*) Size and habit of plant growth; (*b*) freedom from disease; (*c*) early maturity; (*d*) size and shape of leaf; (*e*) quality of leaf; (*f*) smallness of ruffle. All selected plants were "selfed." No crosses were made, since it is undesirable to undertake this work until pure lines have been established and the habit of particular lines is known.

"*Maize.*—The three following strains of maize—Johnson' County White 33-16; Johnson's County White 2-14; and Single cross F. Johnson's County White, 1931 crop, were received through the courtesy of the Bureau of Plant Industry, United States Department of Agriculture, from Dr. A. G. Johnson, with a view to testing them out against local varieties in respect of their resistance to Diplodia infection. A good strain of Salisbury White maize was used as a control. Half the number of plants of Nos. 1 and 3 were "selfed." The percentage of grain which set on the selfed plants was good, being on an average of about 70 per cent.

"From observations of one season it cannot yet be stated that these strains are any more resistant to Diplodia than the

local variety. In addition to work on the American strains, selection for Diplodia resistance is being continued on a strain of Salisbury White maize first selected by the Assistant Agriculturist at the Government Farm, Marandellas in 1931.

"*Wheat.*—The work undertaken with wheat during the past winter has comprised strain tests and the multiplication of small quantities of seed. Three hundred varieties, selections and crosses, were sown, and of these sixty-three have been retained for further trial. Selection in the field was based on the following points—(*a*) General vigour of plant; (*b*) Yield; (*c*) Evenness in ripening; (*d*) Strength of straw; (*e*) Disease resistance; (*f*) Quality of grain.

Several crosses made in previous years show promise.

"*Protein Analysis.*—It has frequently been stated that the average Rhodesian wheat contains only about eight to nine per cent. protein and that in consequence it is not possible to use pure Rhodesian flour in any large proportion for commercial baking, since it is essential that standard flour should contain 11-12 per cent. protein. With this in mind, selections have been based very largely on quality. Analyses of 63 of the selected strains have been made by the Chemistry Branch, the protein content being determined by the nitrogen percentage multiplied by the factor 5.7. The results in some cases are very striking, running as high as 17.44 per cent. crude protein.

"*Barley.*—One plot of Blue Barley was sown, the seed being provided by the Manager of the Castle Brewery, Salisbury, in whose opinion this is the best type of malting barley which is produced in the Colony. The attempt is being made to fix the type."

Maize Grading and Export.—Unprecedented difficulties were experienced by the grading staff owing to the abnormal rains which fell in August. The steady nature of these rains and the lack of sunshine for more than a week caused great penetration of moisture both into bagged maize stacked on farms and along the railway and also into the unshelled "dumps." In many cases moisture content rose in a few days by 2-3 per cent., and in order, when the rain ceased, to give the grain the necessary opportunity to dry, large amounts had to be

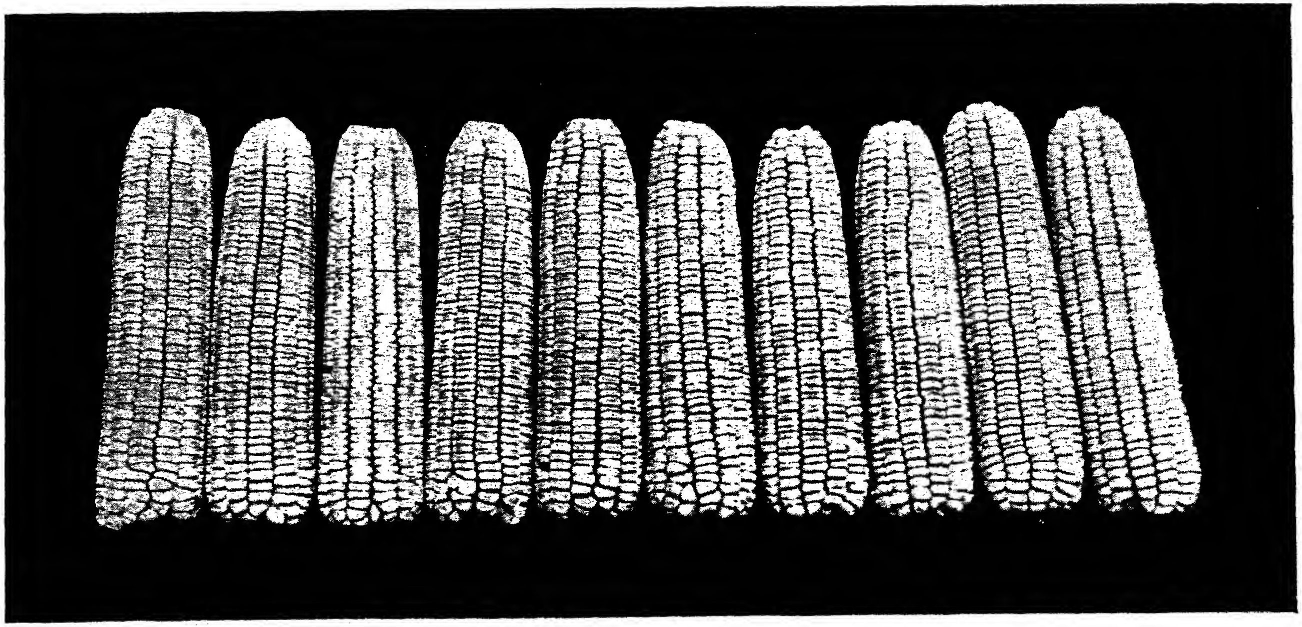
re-stacked or pigeon-hole stacked. The grading staff of five under the direction of Mr. S. D. Timson, Senior Grain Inspector, rose, however, to the position, and eventually established a new record in our grading history, 866,000 bags being graded between July and October, of which 670,000 bags were graded in the last two months. The more general use of motor transport was largely responsible for the rapidity with which the service was performed.

Moisture tests carried out with the Brown-Duval tester also established a record, some 300 samples being submitted by the Maize Control Board and the Farmers' Co-operative Society, Limited, apart from the many forwarded by private farmers and those drawn by the graders themselves.

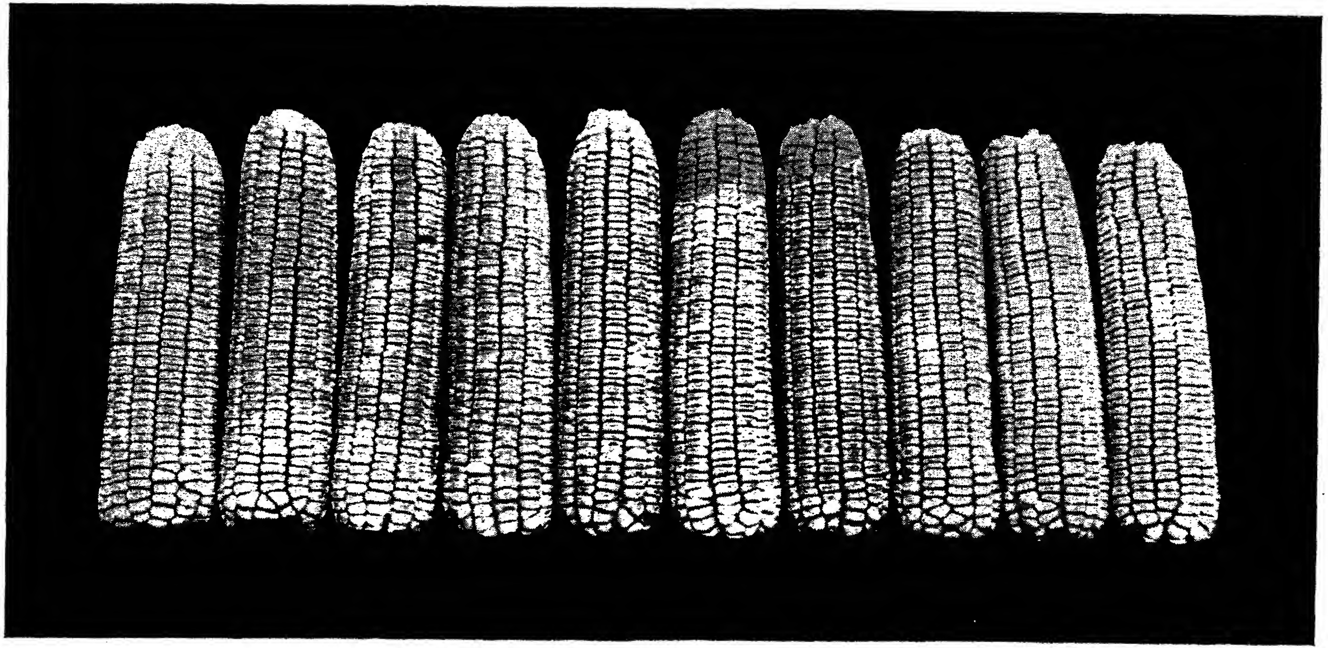
The system of pigeon-hole stacking, while of great advantage in the case of over-moist maize, has proved a not unmixed blessing. Maize stacked in this manner occupies a good deal more space, at stations and sidings, thus sometimes causing severe congestion, and it is also less easy to sample, particularly in the case of the lower two or three rows of bags. As far as possible, pigeon-hole stacking should be confined to the farm, pending transport to railhead.

Railings of new crop maize for export between July and the middle of December totalled 824,000 bags, all to the port of Beira. Exports included a not inconsiderable amount of native-grown maize.

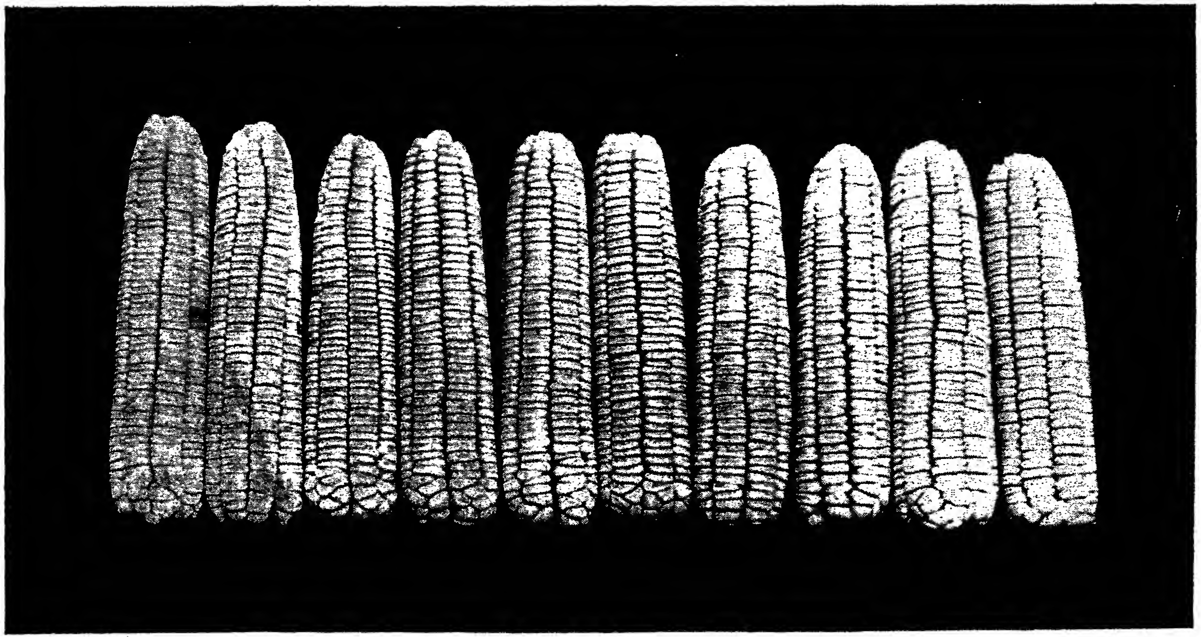
Summary.—The above review of the activities of the Division reveal the fact that in spite of staff reductions and curtailment of expenditure in other directions, sustained progress has been made in solving a number of important problems relating to arable farming and grassland management. For reasons of economy very little travelling or farm to farm tours has been undertaken. All officers of the Division —to whom my grateful thanks are recorded for their efficient and loyal services during the year—are in consequence losing that personal touch with the farmer which has regularly been maintained in the past. Itinerant extension work has thus virtually ceased, but it is hoped that the finances of the Colony will permit of a resumption of these services at an early date.



Mr. G. H. Cautherley's exhibit of Salisbury White. Awarded 25th Prize at the World's Grain Exhibition, Canada.



Mr. J. A. Rennie's exhibit of Salisbury White. Awarded 26th Prize at the World's Grain Exhibition, Canada.



The British South Africa Company's, Mazoe Estate's exhibit of Hickory King. Awarded 27th Prize at the World's Grain Exhibition, Canada.

Report of the Director of Veterinary Research

FOR THE YEAR ENDING DECEMBER 31st, 1932.

D. A. Lawrence, B.V.Sc.,
Acting Director of Veterinary Research.

Routine Work.—The routine work of the Department has, as in former years, consisted of the general clerical and administrative work, the preparation, dispensing and despatch of the numerous vaccines and blood preservative for agglutination tests, the macro- and microscopic examination of specimens submitted for diagnosis and the application of serological tests.

Owing to the officers of the Bulawayo branch of the Veterinary Department being engaged in the control of Foot and Mouth disease, which necessitated their absence in the field for considerable periods, the examination of all surplus smears from Matabeleland was undertaken by this Department, and when it is realised that in an effort to finally eradicate East Coast Fever from that province smears are prepared even from animals slaughtered for consumption, it will be appreciated that this undertaking has lead to a considerable increase in this section of the routine work of the Department.

The general application in the field of the Foot and Mouth disease inoculation process, which originated from this Department last year, has also resulted in a considerable increase in routine work, all the glycerine citrate solution used as a preservative for the virus for such inoculation being prepared at and despatched from the Laboratory.

A further increase in general routine work was experienced as a result of a re-organisation of the Poultry Officer's Department, the ante- and postmorten examination of all poultry submitted for diagnosis being undertaken by this Department. In previous years such examinations were made only during the absence from Salisbury of the Chief Poultry Officer.

From the 1st April the control of the Trypanosomiasis work in the Golden Valley area, which in former years had been in the hands of the Veterinary Department, was handed over to this Department. After a visit of inspection to the area in question it was decided that it would be difficult, if not impossible, to obtain any useful information about the results of treatment of infected stock under existing conditions, and it was decided to take over for experimental purposes the farm where the greatest loss from Trypanosomiasis had been experienced during the past few years. The organisation of this experimental station has lead to a very considerable increase in the general clerical administrative work of the Research Department, but it is hoped that when the experiments are finally in progress the results achieved will fully justify the additional expenditure and labour.

During the year the general work of the Department, both technical routine and experimental, was rendered increasingly difficult by the partial and rarely complete failure of the water supply. It is anticipated that this difficulty will be finally overcome next year by the provision of a borehole and pump, etc., on the Station.

LABORATORY PRODUCTS AND SERVICE.

Diagnosis of Smears.—2,626 blood or tissue smears were examined during the year, of which 123 showed Trypanosomiasis, 86 Quarter Evil, 53 Gallsickness, 16 Redwater, 6 Anthrax, 2 Biliary Fever, 1 East Coast Fever, 1 Spirochætosis,

2 Anæmia and 1 Eosinophilia, the remainder showing no indication of disease, or being decomposed or otherwise unsuitable for diagnosis.

Serological Tests for Contagious Abortion.—608 serum samples were subjected to the agglutination test for Contagious Abortion, of which 102 gave a positive reaction, indicating that the animals were infected. All pipettes and preservative for the collection of the samples were prepared at and despatched from the Laboratory.

Examination of Faeces Samples for the Detection of Parasitic Infestation.—12 faeces samples were examined by the sugar flotation method for the detection of worm eggs, in 6 of which indication of infestation was detected.

Quarter Evil Vaccine.—This vaccine, as in previous years, has been in great demand, its efficacy and simplicity of application being well known and appreciated. 72,548 doses, representing a revenue of £896 0s. 0d., were issued. It would appear that this vaccine is becoming well known in Northern Rhodesia also, as within the last few months some 480 doses have been ordered by the Veterinary Department or directly by stock owners in that Territory.

Infectious Abortion Vaccine.—1,982 doses have been supplied during the year, but it would appear that in some cases the results of vaccination have not been as beneficial as was wished.

Redwater and Gallsickness Virus Vaccine.—This vaccine is only supplied to stock owners for use on calves at heel. 58 doses were issued for this purpose, and it would appear that it has proved entirely satisfactory. During the year seven imported bulls were inoculated at the Laboratory, five from England and two from the Union of South Africa. This small number is, no doubt, due to the fact that stock owners have refrained from importing bulls on account of the presence of Foot and Mouth disease and also owing to the general depression.

Five of the animals inoculated reacted satisfactorily and recovered, but at the time of writing the remaining two have not yet quite completed the Gallsickness reaction, having satisfactorily reacted to and recovered from Redwater. Of the above animals only two were within the specified age limit for inoculation, *i.e.*, not exceeding fifteen months.

It is to be regretted that when considering the importation of valuable stock, owners who desire to have them immunised against these diseases do not consult the Department first and observe its recommendations, and thus obviate the disappointment of not having their animals inoculated or of running a greater risk of losing them under inoculation. Apart from the above consideration of the owner, however, the practise of applying for the inoculation of bulls not conforming with the specifications for inoculation is to be discouraged, as should losses occur amongst such stock whilst undergoing inoculation the process is brought into disrepute, and this will tend to discourage the inoculation of even suitable animals which will then in all probability die from natural infection.

Horsesickness Virus Vaccine.—There was an appreciable increase in the demand for this vaccine during the year, 138 doses being issued. Applications for a further 20 doses were received after it had been decided to discontinue the issue of vaccine for the present season owing to the prevalence of natural infection after the commencement of the rains. Of the total number of 95 horses inoculated by private owners, or in a few cases by District Veterinary Surgeon's, only one fatal result has been reported. Users of the vaccine were asked to complete forms supplied to them indicating the results of the inoculation, and a large majority have reported entirely satisfactory results. In a few cases no reaction was observed, due, no doubt, to the fact that these horses were already immune. In a few other cases the owners had not taken the animal's temperature, and it was therefore impossible to express any opinion on the result of the inoculation, except in one or two cases where obvious symptoms of Horsesickness were observed.

Six Police remounts were successfully inoculated during the early part of the year.

Thirty remounts imported from the Kimberley district in June and one locally bred filly, the property of the B.S.A. Police, three privately owned horses and three purchased for experimental purposes were inoculated under my personal supervision. Of the above 26 were inoculated at the Laboratory, one mortality occurring in an average horse during the process of standardising the vaccine, and 15 at the Police Camp stables, the mortality amongst which was 4. The latter very high mortality was attributed to a combination of factors, the principal of which being that the animals were overage, the extremely changeable weather during the period when the animals were reacting and the effects of which could not be satisfactoritly excluded under existing conditions of stabling, and the failure to achieve the required conditions of "quiet" in a depot where military routine must continue. Apart from the fact of the animals being overage these unfavourable factors were eliminated at the Laboratory with the result that all subsequent inoculations, 15 in number, were attended by no mortality. The very satisfactory results of inoculation of 95 animals in the field indicate the advisability of restricting, for the present at any rate, the application of the vaccine to animals not exceeding 5 years of age.

During the year arrangements were made whereby owners who desire to do so may have their animals inoculated at the Laboratory at an inclusive charge of £4 0s. 0d. per head.

Injections for Fly Struck Cattle.—The issue of Antimony Potassium Tartrate in solution has been continued, some 2,000 doses being supplied during the year. The failure of this drug to produce its desired effect in some instances appears to be largely due to the general mismanagement of the stock, principally overworking and underfeeding.

Antimyiasis Vaccine.—The preparation and experimental issue of this vaccine has continued, 220 doses being supplied during the year, but there has not been as great a demand for it as in the previous year, apparently due to there being an appreciable decrease in the incidence of screw worm cases.

The reports received from users of this vaccine justify its continued issue in its present form as well as further experimentation on the same lines.

Preservative for Foot and Mouth Disease Virus.—Sufficient preservative for Foot and Mouth disease virus for the inoculation of 187,600 cattle was prepared and despatched during the year, the distribution being as follows:—

Bulawayo	8,400	doses.
West Nicholson	69,000	,,
Shabani	12,200	,,
Wedza	16,000	,,
Gwelo	24,500	,,
Umvuma	30,800	,,
Fort Victoria	5,000	,,
Salisbury	12,700	,,
Gwanda	2,000	,,
Lumane Siding	7,000	,,

Miscellaneous.—One severe bilateral case of ophthalmia in a recently imported Ayrshire heifer was brought in to the Laboratory for treatment. Alternate daily applications of yellow oxide of Mercury ointment and a powder consisting of equal parts of iodoform and boracic acid successfully cured this case.

A few animals, other than poultry, brought in to the Laboratory were examined clinically, and in some cases autopsies were made, the necessary advice as to methods of treatment and control of the particular disease being given.

Examination of skin scrapings and similar material for the detection of parasitic diseases such as scab and mange were carried out and the Chief Veterinary Surgeon notified in any such cases where scheduled diseases were detected.

In a few cases autogenous vaccines were prepared from material collected for this purpose and beneficial results from its use were reported.

One case of naturally contracted Gallsickness in one of the outlying cows at the Laboratory was diagnosed and successfully treated.

Revenue and Expenditure.—The total sum provided for this Department under Vote 40 for the financial year was £6,064 0s. 0d., of which some £750 0s. 0d. was utilised to defray the expenses of Mr. Bevan's visit to Weybridge and of the Foot and Mouth disease research conducted there. The revenue derived from the sale of vaccines and laboratory products, the inoculation and attendance of privately owned animals and the sale of experimental animals during the past calendar year amounted to approximately £1,340 0s. 0d.

RESEARCH.

Owing to the absence of the senior professional officer and the general increase in the routine and administrative work, the research work of the Department has of necessity been limited, and in view of the urgent necessity of investigating problems associated with Foot and Mouth disease this subject received the major portion of the time which could be devoted to research.

Foot and Mouth Disease.—During the first month of the year experiments were conducted by Mr. Bevan with a view to perfecting the method of inoculating cattle which was described in his Report for 1931. In view of the entirely satisfactory reports on the method when applied under general conditions in the field it was considered unnecessary to proceed further on these lines, and subsequent research was devoted primarily to the determination of the effects of the virus on animals other than bovines under local conditions.

Some considerable difficulty was at first experienced in obtaining a virus which was capable of establishing a typical infection even in bovines when administered by the intra nasal route, and it was only after such a virus was obtained that definite experimentation could be undertaken.

The Disease in Guinea Pigs.—In view of the reports from Weybridge which emphasised the difficulties of establishing and maintaining the Rhodesian virus in guinea pigs the first experiments were directed towards this object, in order that guinea pig virus might be supplied from here and thus facilitate the work of "typing" the virus at Weybridge. Earlier experiments of this nature had failed to demonstrate

the susceptibility of small laboratory animals to the Rhodesian virus, but vesicular fluid from fresh lesions in a bovine, reacting to intranasal inoculation with blood virus collected in the Belingwe reserve, on inoculation into two guinea pigs by the intradernal plantar pad and intramuscular methods produced the typical disease in both of them. The vesicular fluid from the lesions produced in these animals failed, however, to produce infection when similarly inoculated into two other guinea pigs. It therefore became necessary to infect further guinea pigs with bovine virus. Blood virus, which was highly infective to cattle, when inoculated into four guinea pigs failed to produce any reaction in three of them and only a very delayed and mild reaction in the fourth. However, a suspension in liver broth of crushed vesicular epithelium obtained from a bovine produced the disease in a typical form in the two guinea pigs inoculated with it. Similarly, inoculation of two guinea pigs with pure vescular fluid from a bovine foot lesion resulted in typical infection after an incubation period of twenty-four hours. In view of the apparently ready adaption of this particular virus to guinea pigs some of it, both from bovines and guinea pigs, was sent to Weybridge by air mail and the remainder was used to carry on the infection of guinea pigs at this Laboratory. The virus was successfully kept going for eight generations in these animals, but it was noticeable that the 7th and 8th passages were less virulent than the earlier ones, and the 9th sub-inoculation failed to produce infection. As by this time it was decided to discontinue Foot and Mouth disease experiments at the Laboratory, the rest of Mashonaland by then being "clean," and as reports had been received from Weybridge indicating that the typing of the Rhodesian virus was progressing satisfactorily, further infection of guinea pigs was not attempted. Later reports from Weybridge indicated that in some cases the virus had not become fully adapted to guinea pigs until after 32 passages, although a report from the Kabete Laboratory stated that fixation was apparently complete by the 5th passage.

The Disease in Pigs.—Cases of pigs having become infected by feeding on milk or carcases of infected cattle was reported by the Chief Veterinary Surgeon. All previous experiments

at the Laboratory had failed to demonstrate the susceptibility of these animals to the Rhodesia virus under local conditions, although an early report from Weybridge indicated that this fact had been established in experiments there after the virus had first been rapidly passed through highly susceptible animals. The preliminary experiments in this connection failed on account of the difficulty of establishing infection in bovines as previously mentioned. Subsequently, however, infection was successfully produced by inoculating pigs intramuscularly with blood virus collected from naturally or artificially infected cases in the field, and also by feeding them on the milk of a cow infected at the Laboratory.

It is particularly interesting to note that three young pigs developed typical interdigital vesicles as a result of being inoculated intramuscularly and intranasally with bovine blood virus without showing any evidence of a thermal reaction, even though their temperatures were recorded twice daily. Two pigs which were regularly fed on a limited quantity of milk from a cow which had been inoculated and subsequently reinoculated with blood virus developed typical thermal and clinical manifestations of infection, whereas the cow supplying the milk showed no indication whatsoever of having been infected nor did the calf which she was suckling.

In neither of the above cases of infection in pigs could any statement concerning the incubation period of the disease in these animals be given, owing in the first mentioned case to the absence of thermal reactions, the lesions only being detected after they had ruptured, and in the second case to the absence of any indication of infection of the cow whose milk produced the disease. Three pigs fed on two gallons of milk daily from a cow infected by intranasal and intramuscular inoculation developed typical Foot and Mouth disease within four days of the time of inoculating the cow. It may be assumed that this cow's milk was not infective prior to her first temperature elevation, and it would thus appear that the incubation period of the disease in pigs fed on infective milk falls within a period of 64 hours. It is also interesting to note that amongst these pigs one developed a thermal reaction followed by lesions, one developed lesions before a

thermal reaction, and the third had definite lesions in the absence or only very doubtful presence of any temperature elevation. In another case a pig inoculated intramuscularly with the pure vesicular fluid from a foot lesion of a bovine developed a definite thermal reaction after an incubation period of 93 hours, but lesions were not evident until the 8th day.

Virus from pigs proved, as was to be expected, readily infective to bovines, the incubation period of the disease in the latter species being 4 days, following inoculation with as little as .50.c.c. instramuscularly and .05.c.c. intranasally of vesicular fluid collected from a lesion on a pig.

The Disease in Sheep.—As in the case of pigs previous experiments failed to demonstrate the susceptibility of sheep to the local virus, although one or two very doubtful cases of natural infection of this species were mentioned as having been observed in the field. The majority of reports, however, were that sheep grazing together with infected cattle, or over pastures which had been grazed immediately previously by such cattle, failed to reveal any evidence of having contracted infection even after they were subjected to a close examination.

It therefore appeared to be of great importance to investigate this matter further.

The preliminary experiments yielded no definite results. Two of the animals died during the experiments, one from verminous cachexia and the other from Trypanosomiasis, an infected animal having been inadvertently supplied for the experiment. In another experiment only very indefinite tempertature reactions were recorded, and as at that time it was not realised that lesions may be present even in the absence of a thermal reaction, these animals were not subjected to a detailed clinical examination. In a third experiment two sheep were inoculated intranasally and intramuscularly with preserved bovine blood virus which at the same time was proved to be infective to cattle, pigs and guinea pigs.

One of these commenced a definite temperature reaction on the 3rd day after inoculation, and the other failed to react. Careful daily examination of these sheep failed to disclose

any lesions. Blood collected from the sheep showing a distinct thermal reaction set up the typical disease when inoculated into a bovine and other sheep, and the blood of these sheep proved in turn infective to others.

These experiments thus proved definitely that the Rhodesian virus could be adapted to sheep and that when so adapted it was still readily infective to cattle. From observations during the course of the above experiments, however, it would appear that the disease in sheep could only be detected with the greatest difficulty under the conditions which obtain in the field. In the first place there may be no marked temperature elevations during the course of the disease, and it would therefore be extremely difficult, if not impossible, to detect such an indefinite elevation amongst sheep which are grazing and have to be chased before being caught to be temperatured. Secondly, none of the infected sheep in the experiments showed any marked general disturbance such as would enable one to pick out a diseased sheep from a flock, and thirdly, the lesions in the experimentally produced cases, though quite definite, were so mild that it was only by thorough daily examination that their presence could be detected.

The Disease in Natives.—Reports were received from an area where Foot and Mouth disease was prevalent that natives were showing indications of having contracted the disease. Infection was considered to take place as a result of native children milking infected cows directly into their mouths, or even sucking the milk from them. But the disease was also reported as occurring amongst whole families, not excluding the adults. In view of the possibility of infected human beings being a means of disseminating infection swabs collected from one such case were subjected to the biological tests, but the results were entirely negative. The symptomatology of these alleged cases of human infection by no means corresponded to that of known cases of Foot and Mouth disease in man, and it would appear to be extremely improbable that a single definite case of human infection during this outbreak of the disease can be cited.

General.—During the course of the above experiments attempts were made to determine the period of infectivity of recovered bovines and of the excreta, and it is worthy of note that in no case was even the minimum period determined. One bovine, four days after its thermal reaction had subsided was placed in close contact with another, but even though the experiment was continued for some weeks no infection of the susceptible animal resulted.

Similarly a susceptible bovine immediately placed in a stall vacated by a bovine which had just completed its thermal reaction failed to contract infection, even though this stall contained the excreta voided during the previous few days by the infected animal.

One cow whose milk proved highly infective when fed to four pigs was also tested to determine for how long a period her milk would remain infective. On the 10th day after the date of inoculating this animal, or the ninth day after she first commenced to react or again the sixth day after her thermal reaction had terminated, her milk was fed twice daily to two pigs, but neither of these became infected, even though at the time when this feeding experiment was commenced the cow still showed definite unhealed lesions.

Two cases of what was apparently an exceptionally prolonged incubation period of the disease in bovines were observed during these experiments. The animals had previously been used in "in contact" experiments and had failed to react. They were subsequently inoculated intranasally with blood virus and it was at first considered that this virus was non-infective. During the fourth week, however, one animal showed definite temperature elevations without any clinical manifestations of infection, and blood smears prepared from it failed to reveal any cause for this reaction. On the 35th day after inoculation its temperature rose to 106.2° F. and typical lesions of Foot and Mouth disease were present on the following day. The second animal maintained a normal temperature until the 36th day, when a reaction commenced and lesions were detected two days later.

A few cases in which the incubation period appeared to be 15 days were observed, but in these cases only a thermal reaction resulted. Cases of prolonged incubation periods have

subsequently been reported during the course of the protective inoculation of cattle in the field, but such cases are only exceptionally encountered.

Horsesickness.—This subject has already been dealt with at some length, under the heading "Laboratory Products and Service," the research work being confined entirely to the routine preparation of virus-vaccine for general issue during the year.

Sufficient virus for this purpose had been collected during the previous year, but unfortunately this proved to be no longer active after April, and it was therefore essential that fresh stocks should be prepared.

For this purpose three young horses were imported from the Union of South Africa, but unfortunately they failed to react to inoculation. Subsequent inoculation with a different stock of virus produced a reaction in only one of them, and this was so severe and atypical that it was considered unwise to collect virus from this animal.

Later, horses supplied for experimental purposes by the Commissioner, B.S.A. Police, were inoculated with other stock virus and two of these reacted satisfactorily and were bled. The virus thus collected from one of these animals was tested out on others and the standard dose was arrived at.

As already indicated, this virus proved entirely satisfactory when used on horses under five years of age. A number of animals over this age were also inoculated, but the mortality amongst them was such as to necessitate restricting the use of the vaccine to horses not exceeding five years.

Redwater and Gallsickness.—As in the case of Horsesickness the work on these diseases was limited to the preparation of fresh "bleeders" for vaccine purposes. Three locally bred susceptible grade Sussex steers were inoculated with blood from two bleeders which had been used during the previous year. These animals reacted satisfactorily to Anaplasmosis, but only one developed Piroplasmosis. It was therefore necessary to re-establish Piroplasms in the original bleeders. The new bleeders have not yet been tested out on imported and

therefore highly susceptible stock, but the blood of one of the old ones, after re-inoculation for Piroplasmosis still continues to give satisfactory reactions.

Trypanosomiasis.—No research work on this disease was carried out at Laboratory during the year, and the actual experiments under field conditions have not as yet commenced.

Past experience has shown that treatment by intravenous injections of Antimony potassium tartrate is of decided value, but under the conditions which obtain in the Golden Valley area this method of treating infected stock either within the "fly" area or after their removal to a "clean" area has not sufficed to keep the animals alive and in a workable condition. After investigation this apparent failure of the drug to produce the desired effect was attributed largely to the fact that infected animals could not be kept under sufficiently close control, with the inevitable result that they suffered not only from Trypanosomiasis but to a very appreciable extent from poverty and overwork; in fact, it would appear that these last-mentioned factors were primarily responsible for the high mortality amongst the Government-owned oxen which constituted the greatest number of stock in the area.

Under such conditions therefore it was regarded as impossible to obtain any reliable data as to the efficacy of the various methods of drug treatment which it was deemed advisable to try out, and for this reason the farm "Woodstock," on which the most serious losses had occurred during the past few years, was taken over for research purposes.

This farm, which is under the supervision of Mr. Curran, has now been stocked with oxen and cows and a series of experiments will be commenced as soon as these animals become infected, with the hope that at least one method of treatment will prove effective in keeping animals not only alive but in a condition fit for work, breeding and milk production.

During the year there appeared to be an appreciable increase in the losses from Trypanosomiasis amongst stock in the Gwaai settlement area. No systematic treatment of infected animals was being applied, and Mr. Curran was detailed to investigate the conditions in that area and demonstrate the method of treatment to those stock owners concerned.

Poultry Diseases.—Towards the end of last year experiments were commenced with a view to facilitating the testing of poultry for Bacillary White Diarrhœa and Fowl Typhoid. The ordinary slow or rapid agglutination test for these diseases necessitates collecting at least a few cubic centimetres of blood from each bird in order to obtain sufficient "serum" for a test, and in view of the proved suitability of "whole blood" for the agglutination test for Contagious Abortion, it was considered advisable to attempt to apply the "whole blood" method in the detection of these poultry diseases. These experiments proved entirely satisfactory, and it was found that by adopting the American method of staining the antigen with crystal violet solution the interpretation of the results of the test was further facilitated. In the preliminary experiments the minute quantity of blood required for each test was measured by means of a graduated pipette, but it was later found that a sufficiently accurate amount of blood could be collected by means of a wire loop, thus considerably adding to the rapidity with which the tests could be performed.

The method finally adopted was briefly as follows:—The antigen consists of a moderately dense suspension of a sensitive strain of Bacillus pullorum stained with crystal violet solution; 0.05.c.c. of the antigen is dropped by means of a pipette on to a clean glass plate; 0.02.c.c. of blood measured by means of a wire loop adjusted to pick up and deliver this amount is then collected from the bird to be tested by puncturing the vein in the region of the radio-humeral joint and simply dipping the loop of wire into the blood which wells up. The antigen and blood are then mixed together, the same wire loop being used for this purpose, and the glass plate gently warmed by passing it over a small flame. The results can be read immediately or within two minutes.

It was found that this test gave as accurate results as the slower and more cumbersome ones, and the fact that 200 birds were tested by this method in four hours suffices to indicate the rapidity with which the whole test can be completed, the testing of this number under ordinary conditions would otherwise no doubt have required at least two and most probably three days.

During the year arrangements were made to obtain supplies of material for chicken-pox vaccine from the Director of Veterinary Services, Pretoria. As the dispensed vaccine is only suitable for use within a week of preparation it was impossible to obtain it from the Union in time to apply it in certain parts of this country. The vaccine is now dispensed locally as and when required and is therefore available for use in all but the most isolated localities.

It is to be regretted that under existing conditions it has not been possible to devote more time to research on the many other diseases and conditions which are a constant menace to the pastoral industry in this country, and it would appear unnecessary to emphasise the desirability of such research in the future.

SALES.

Agricultural Experiment Station, Salisbury

Spineless Cactus Slabs (blades) Algerian variety, per 100 Slabs 7/6 delivered at the Salisbury Experiment Station, or 10/- delivered free by rail to any station or siding in Southern Rhodesia. For amounts of 500 slabs or more a reduction of 2/6 per 100 will be made.

Kudzu Vine Crowns, per 100 Crowns 15/- delivered at Salisbury Experiment Station, or 25 Crowns 7/6; 50 Crowns 15/- and 100 Crowns 22/6, delivered free by rail to any station or siding in Southern Rhodesia. Delivery during January for dry land. Owing to pressure of other operations it is not possible to deliver Kudzu Crowns during November and December.

Woolly Finger Grass, 10/- per bag of roots, delivered free by rail to any siding or station in Southern Rhodesia; supplies limited. Available in Jannary and February.

Swamp Couch Grass, 10/- per bag of roots, delivered free by rail to any siding or station in Southern Rhodesia. Available in January and February.

The prices quoted do not include charges for road motor transport. Cheques should be made payable to the Department of Agriculture, and preliminary enquiries and subsequent orders should be addressed to the Chief, Division of Plant Industry, Department of Agriculture, Salisbury.

Locust Invasion, 1933.

SOUTHERN RHODESIA.

Monthly Report, No. 10. September, 1933.

Tropical Migratory Locust (*Locusta m. migratorioides*).—No reports of this species have been received during the month.

Red Locust (*Nomadacris septemfasciata*).—Winged swarms have been prevalent in most parts of the Colony and have exhibited considerable activity, but their flights have been limited and have followed no particular direction.

The eastern border of the Colony is haunted by large swarms which cross and recross the border between the eastern districts and Portuguese territory.

On the main plateau of the Colony the swarms come and go from various directions. The formation adopted is very loose and the swarms tend to cover very big areas. Locusts detached from definite swarms are to be met with freely in many localities.

Appreciable damage is reported in respect to irrigated crops in certain parts of the Colony.

At the end of the month females mostly show the beginning of ovary development whilst the males have advanced considerably further in the direction of sexual maturity.

The colour of the locusts remain deep red and the purplish pink suffusion at the base of the hind wings is now well developed.

There are as yet no indication that egg-laying is imminent.

RUPERT W. JACK,
Chief Entomologist.

Southern Rhodesia Veterinary Report.

AUGUST, 1933.

AFRICAN COAST FEVER.

There have been no cases at any of the infected centres.

TRYPANOSONMIASIS.

Six deaths and eight fresh cases occurred in Melsetter district.

ANTHRAX.

Two cases occurred at an old infected farm in Mazoe district and all in-contact cattle were inoculated.

MALLEIN TEST.

62 horses and 4 zebras were inoculated on importation with negative results.

EXPORTATIONS.

To the United Kingdom *via* Union ports in cold storage: Fore quarters, 7,115; hind quarters, 7,464; boned meat, 148,904 lbs.; livers, 33,464 lbs.; tongues, 14,711 lbs.; hearts, 10,263 lbs.; skirts, 5,057 lbs.; shanks, 2,005 lbs.; tails, 5,743 lbs.

Southern Rhodesia Weather Bureau.

SEPTEMBER, 1933.

Pressure.—Mean barometric pressure was considerably above normal during the month.

Temperature.—The mean maximum temperature was considerably below normal and the mean minimum temperatures were also below normal.

Rainfall.—A few showers were recorded on the 21st, 27th and 30 of the month.

SEPTEMBER, 1933.

Station.	Pressure Millibars, 8.30 a.m.		Temperature in Stevenson Screen °F.								Rel. Hum.	Dew Point	Cloud Amt.	Precipitation.			Altitude (Feet)
			Absolute.		Mean.												
	Mean.	Normal.	Max.	Min.	Max.	Min.	½ Max. Min.	Normal.	Dry Bulb.	Wet Bulb.	%	F.	0-10	Ins.	Normal	No. of Days	
Angus Ranch... ...	...	...	96	48	82.0	55.1	68.5	70.9	66.6	57.4	57	41	...	Nil	0.1	...	...
Bindura...	895.2	...	89	46	79.6	52.4	66.0	...	65.5	55.0	50	46	1	Nil	0.1	...	3,709
Bulawayo	872.6	870.9	91	43	77.9	50.7	64.3	67.5	64.0	52.6	45	41	2	Nil	0.2	...	4,425
Enkeldoorn	861.0	...	89	42	76.7	48.8	62.7	67.0	62.9	53.3	53	45	1	Nil	0.1	...	4,787
Fort Victoria	899.3	898.4	93	40	78.7	49.9	64.3	66.1	64.7	54.7	51	46	...	Nil	0.2	...	3,570
Gatooma	...	...	93	43	84.1	50.0	67.0	71.0	65.1	53.9	48	44	1	Nil	0.1	...	3,870
Gwanda	910.1	...	94	45	79.5	52.3	65.9	...	65.4	55.0	50	46	1	Nil	0.2	...	3,228
Gwelo	866.1	...	90	39	78.0	49.7	63.8	67.2	63.2	52.3	46	42	1	Nil	0.2	...	4,627
Inyanga	840.0	...	81	40	71.8	46.9	59.3	...	63.0	51.3	43	40	1	0.30	0.2	1	5,520
Manchester...	...	...	80	39	66.2	46.3	56.3	..	52.8	49.4	79	47	...	0.94	...	4	...
Miami	882.0	...	87	45	78.3	51.6	64.9	...	66.3	55.4	49	48	1	Nil	0.0	...	4,077
Mount Nuza	804.3	...	74	38	60.6	44.0	52.3	...	50.9	46.4	71	42	3	1.34	...	3	6,666
Mtoko	881.0	...	89	46	77.5	54.1	65.8	...	65.8	55.6	53	47	1	Nil	0.0	...	4,190
New Year's Gift...	...	...	97	45	80.7	52.5	66.6	...	66.7	58.9	62	54	...	0.11	0.3	2	2,690
Nuanetsi	966.7	...	...	...	...	...	...	...	69.0	60.4	61	55	3	0.03	0.2	1	1,650
Riverbank...	...	...	96	45	84.2	52.4	68.4	71.0	65.5	53.7	45	45	...	Nil	0.2	...	4,090
Riverdene North	...	...	96	36	80.5	45.7	63.1	...	64.2	55.1	56	48	...	Nil	0.3	...	3,700
Rusape...	865.6	...	87	39	75.8	47.0	61.4	...	62.3	52.6	51	44	1	0.09	0.2	1	4,630
Salisbury	858.0	857.1	80	42	77.1	50.3	63.7	66.6	63.5	52.7	46	43	...	0.22	0.3	2	4,885
Shabani	911.5	...	96	51	79.4	55.8	67.6	...	65.7	55.6	52	47	3	0.09	...	2	3,192
Sinoia	891.3	...	91	41	81.9	48.4	65.2	...	67.8	55.3	44	45	...	Nil	0.2	...	3,793
Sipolilo...	888.3	...	87	48	78.4	55.6	67.0	...	...	...	...	...	1	Nil	0.1	...	3,875
Umtali...	897.2	895.9	91	47	75.8	52.6	64.2	67.4	63.0	56.1	64	51	3	0.22	0.5	2	3,670
Wankie	929.6	...	98	55	89.0	63.2	76.1	...	72.8	56.5	33	42	...	Nil	0.0	...	2,566

Farming Calendar.

NOVEMBER.

BEE-KEEPING.

Now that the first honey flow is on, be sure the hives stand level, whether working them for extracted or section honey. This is important, saving annoyance when preparing the product for market. Occasionally. where bees have not been thoroughly subdued, they object to the removal of honey; postpone the operation for 24 hours. Where increase of stocks is required. artificial swarms can now be made. Use care in storing honey.

CITRUS FRUITS.

If no appreciable rain has fallen, irrigation must be resorted to in order to keep the trees in good growth and to prevent any check to fruit development. This is a good month to plant green crops. Sunn hemp is possibly the best crop to smother weed growth and supply humus-forming material after it is ploughed in. If not already done, storm drains should be made on the sloping ground to prevent erosion of the surface soil during heavy storms. Where new plantings are contemplated, the holes should be dug and everything got in readiness for planting if the trees are ready for lifting in the nurseries. All unthrifty trees could with advantage have an additional amount of fertiliser and manure applied during the month. Keep down all water shoots.

CROPS.

Take note when the first rains fall, and see what leaks there are, if any, in the farm buildings. Do not neglect to effect such repairs as are necessary. Early in the month see that the planters are in perfect order, and that they drop the different seeds to be planted evenly and at the right distance. Try them out on the farm road. Hasten the work of getting the lands for early sown crops into as good a condition for seeding as possible, so that the first and most favourable opportunity for planting may be seized. The young plants make more rapid growth in a good seed bed. Utilise exceptionally early rains for this purpose rather than for planting. The holes for check-row planting of maize can continue to be prepared until sufficient rain has fallen to allow of planting. Velvet beans and dolichos beans for seed or hay may be planted dry if the land is in good order. With favourable weather, planting of maize, velvet and dolichos beans and cotton will commence about the middle of the month, and will continue as the condition of the land and the rainfall permit. Main crop potatoes should be planted from now on to January. Dhal may be planted for seed or green manuring—if for seed, a frost free situation is necessary. Kaffir corn for seed may be planted this month. Green-manure crops requiring a long growing season should be planted. Destroy, by feeding or burning, early planted trap crop of maize or volunteer plants which have become infested with stalk-borer.

If weeds are beginning to show, keep the harrows going in front of the planters. If weeds are too advanced to be killed by drag harrows and too numerous to be dealt with by hand labour, use the disc harrow or lightly re-plough the land. If the tilth is good, do not be afraid to harrow the young maize. This will save much labour later on by destroying the weeds while they are small.

DECIDUOUS FRUITS.

Continue thinning out fruit on the trees if a very heavy setting has occurred. A small amount of large-sized fruit is preferable to a large crop of small fruit. Thin down the inner growth of new shoots if they have a tendency to crowd each other, and stop all suckers and main stem growths as they appear.

ENTOMOLOGICAL.

Maize.—Crops planted before the last week in this month are liable to suffer later from stalk borer. At Salisbury, crops planted after 27th November have escaped serious injury, but early December plantings are probably the safest. Volunteer maize is commonly badly infested and should be cut out and removed immediately, otherwise the borers tend to spread to surrounding plants. If rain has fallen sufficiently early, lands may be baited at the end of the month against surface beetles, snout beetles and other pests which tend to reduce the primary stand of plants. The formula is arsenic of soda 1 lb., cheapest sugar 8 lbs., or molasses 1 gallon, water 10 gallons. Dip chopped Napier fodder or other green stuff and distribute broadcast. The poison may be sprayed over volunteer maize and weeds on land with good effect. Cutworms do not usually appear in numbers until December, except in low-lying lands. Succulent green stuff soaked in a 2 per cent. solution of sodium fluoride is the most recent formula for poisoned bait, but destruction of these pests is difficult. Keep the land clear of weeds as a preventive measure. If the young plants are attacked by the black maize beetle (heteronychus), the only remedy is to destroy by hand. Good, clean farming will control these pests to a large extent.

Tobacco.—This crop is subject to many pests in its early stages, although attacked by a few after vigorous growth has started. Keep cheese cloth covers on seed beds at night to exclude pests, and spray regularly with arsenate of lead (powder) 1 lb. in 30 gallons of water to protect against leaf-eating insects, etc. Lands may be baited against surface beetles with maize bran moistened with arsenate of soda 1 lb. in 30 gallons of water. Distribute in balls about the size of a golf ball and cover with branches or anything to protect from sun. Place one ball to each ten plants and moisten again when dry.

Potato.—The first brood of leaf-eating ladybirds appear in November. Spray with arsenate of lead (powder) 1lb. in 30 gallons of water. Spraying is also useful against the black blister beetles, which sometimes attack the crop on sandy soils. Keep the soil of irrigated crops well hilled and in friable condition as a precaution against tuber moth laying eggs on the tubers.

Kitchen Garden.—Plants of the cabbage family are liable to attack by diamond-back moth and other leaf-eating insects. When considered desirable, young plants may be dusted lightly with arsenate of lead (powder). Cabbage aphis may be kept in check by liberal watering and frequent washing with a forceful stream of water from a hose pipe or spray pump. Drenching the plants regularly with cold water is also held to be a good remedy for the diamond-back moth mentioned above.

Deciduous Fruits.—Young trees may need spraying with arsenate of lead (powder) 1 lb. in 20 gallons of water as a protection against chafer beetles, whose attack may check the growth very seriously. Choice varieties of early peaches may be netted to protect them from fruit-piercing moths.

When in doubt as to the identity of any pest or the method of dealing with it, apply promptly to the Chief Entomologist, Salisbury, bringing or sending specimens of the insects concerned. Note, however, that it is sometimes feasible to prevent injury from pests for which no practical remedy is known. Farmers should therefore endeavour to obtain some knowledge of the pests of the crops they are growing through the articles published in this Journal.

FLOWER GARDEN.

All seeds may now be planted. Annuals for January flowering should be sown, amongst which the following will be found to be excellently in this Colony:—Balsam, Calliopsis, Centurias, Chrysanthemum, Dianthus, Escholtzia, Marigold, Mignonette, Gallardia, Phlox. Poppy, Nasturtium, Nigella, Verbena and Zinnia. These are all hardy, and may be sown in the open either in beds or in the position desired for flowering. Advantage should be taken of each shower of rain during this month to keep the soil well worked and loose.

VEGETABLE GARDEN.

All vegetable seeds may be sown during this month. Tomatoes and early peas and beans should be staked. The soil should be kept loose and free from weeds, which now get troublesome. Sow pumpkins, mealies, peas and potatoes.

FORESTRY.

Sowings of eucalypt (gum) seed should be made for late planting. If fresh seed of cedrela toona is available, sowings should be made. Keep the seed beds moist and free from weeds. The tap roots of early seedlings may be cut back in order to form hardy, stocky plants most suited for planting. Continue with pricking out if transplants are to be used. Prepare all land to be planted by cross-ploughing and harrowing. A well prepared soil is a good fertiliser; it assists establishment and reduces failures.

POULTRY.

Some birds will now be commencing to moult. This will cause a decrease in the number of eggs laid. The poultry keeper, therefore, should see that his birds come through the moult as quickly as possible. Some birds will lay and moult simultaneously, but these are the strongest, most vigorous and the best layers; the majority do not. The process of moulting is a natural one, but it is a severe strain on the system. Fowls that are not too fat, and can stand extra feed at the commencement of the moult, come through it best. More green and animal food should be given, and the utmost care taken that they are not exposed to cold or wet, otherwise they will not only take longer to moult, but go off in condition. A little linseed stewed, or linseed meal, or ground nut meal and milk should also be given. There will next month be a demand for table birds, and such as the poultry keeper intends to sell should be selected. In making this selection, it is no use choosing old or scraggy birds, for it is hopeless to attempt to fatten these, or make them good table birds. Do not coop them up till a fortnight or so before they are to be sold give them free range and feed them well, with at least one feed of soft food mixed with milk once a day. Turkeys destined for the Christmas market should have free range, but also a feed of soft food once a day, and a good feed of mealies in the evening.

STOCK.

Cattle.—Normally rains should have fallen and the veld should be plentiful now. Beyond careful dipping, ranchers should not have much worry. If the season is bad, the poorer cattle should be drafted out and given a little hay, ensilage or maize daily. The grazing should be improving rapidly in feeding value. If normal rains have fallen, the grass should be sufficient for cows of average production. Heavier milkers should be fed concentrates at the rate of about 3 lbs. per gallon of milk produced over the first. In most cases maize meal alone will be sufficient for the purpose.

Sheep.—Dip sheep; put the rams to the ewes; keep the sheep on high dry land; be sure the kraal or sheep shed is dry and clean, and that there is shelter from the rain for young lambs.

DAIRYING.

In a normal year veld grazing should be plentiful in November, and the feeding of dairy stock is then very much simplified; veld grass in a green and succulent condition is practically all that is required for animals of less than average production. Heavy milking cows, however, on early pasture, require extra feed in the form of concentrates, while the latter should always be fed to dairy stock which are in poor condition at this time of the year. Young calves should not be turned out to graze with the herd, and in wet weather are best kept in a clean, dry, airy pen. Weaned stock, which have not hitherto had access to green pasture, should be gradually accustomed to the change in diet and may at first be turned out to graze for short periods. Young stock on pasture should also receive a small daily allowance of concentrates.

Farmers supplying cream to the creamery should adjust the cream screw to the separator so that the latter will separate a cream testing 45 to 50 per cent. butter fat. Cream of this consistency will keep better than thinner cream. It should be borne in mind that it is practically impossible to produce first-grade cream if the cattle are milked in a muddy kraal. In the absence of a cow shed, every endeavour should be made to erect a small milking shed in which four or five cows can be tied, milked and fed. A small shed of this kind is also essential to obtain clean milk for cheese-making. Milking in a muddy kraal invariably results in a gassy, bitter cheese being produced.

The shelves of the cheese room should be scrubbed with boilinig water and soda, and for the last rinsing a weak solution of formalin may be used. This should prove effective in controlling cheese pests.

TOBACCO.

Continue to sow seed beds, watering. etc. When early beds become overgrown and hard, pull out, dig up and re-sow. Begin transplanting with the first good rains, and continue as fast as the rains and planters will allow, until the crop is set out. Be careful to fill in the misses from previous transplanting before starting on new fields; use the stoutest and best plants for filling in, and try to get the tobacco from any one field to grow and come to maturity as near at the same time as possible. Discontinue filling in when the field has been planted for several weeks and has made a good start to grow, as the later filled in plants will be choked out by the earlier ones, and will not come to maturity. Cultivate fields as soon as plants are established, to keep down weeds.

VETERINARY.

Early heavy rains might bring on horse-sickness before its usual time, but as a rule it need not be feared till the first rains are over in December.

WEATHER.

The rains should be commencing, if not already begun; occasionally they have delayed until December, and even later, before setting in properly. Between spells of wet weather lasting several days, fine dry periods occur, at first clear, but later cloudy and thundery, gradually gathering to burst in thunderstorms. The mornings are generally fine, and rain falls chiefly in the afternoon or evening. Heavy downpours are to be expected, and should be provided against beforehand by means of ditches and embankments, and by clearing water ways and furrows. In a normal season the rainfall varies from two-and-a-half to three inches in Matabeleland, and from three-and-a-half to four inches in Mashonaland generally, with the exception of the eastern border, where it amounts to five inches. Between the rain periods and prior to the commencement of the rains, severe heat is likely to be experienced.

DECEMBER.

BEE-KEEPING.

With a normal season the first or main honey-flow of the year should now be over and the honey ready to be robbed. Before doing this, see that all or the main portion of the frames are capped and sealed, otherwise there will be trouble later on by fermentation. There is nothing on the market to equal the Porter bee-escape board to clear out the bees from the crate, but be sure and see that the board in question is placed the right side up under the crate; failure to do this (and in the hurry of the minute it can easily be so done) will result in the probable suffocation of the bees and the loss of the honey, to say nothing of the chances of robbing from any close-by hives. Replace the empty combs and frames as soon as possible on the hives, to be cleaned up and mended where necessary, and for future storage of more honey. During the very hot spells watch the hives and provide extra ventilation, by inserting small metal wedges between the crates, just wide enough to allow air in, but not a bee under any consideration. Keep all water tins under the hive-stand legs full of water, and see that water is available for the worker bee, which drinks a good deal. When extracting honey, do so in a bee-tight room or verandah, otherwise the operator may have a lot of trouble from other colonies, which quickly find where honey is. Always have one or more crates of shallow frames ready with foundation fixed to place on hives as the season may warrant; such will mean always something for the bees to work at, and during the last flow they may be invaluable to store any such catch crop of nectar, as from tobacco, etc., when the natural flora is finished.

CITRUS FRUITS.

This is a good month to plant citrus trees in their permanent positions. They should on no account be planted deeper than they stood in the nursery. Water each tree immediately after planting it to settle the soil, then loosen the surface when sufficiently dry to check weed growth and restrict evaporation; continue loosening the surface soil after each rain or watering. If good rains have fallen, disc the grove in two directions, then sow the cover crop and harrow also in two directions. If the grove is weedy it should receive a shallow ploughing in place of the discing. Then sow the seed and harrow the soil. All bearing trees must be kept well watered if the weather continues to remain dry. Trees that suffer for want of moisture while the young fruit crop is developing will be adversely affected, and the crop—if any—will be of inferior quality. Continue to rub off all water shoots or suckers which develop on the tree stems.

CROPS.

Keep the cultivators going, both on planted and unplanted lands, whenever weather conditions are favourable. Destroy the weeds while young and before they obtain a firm root-hold.

Continue planting maize, cotton, beans and ground-nuts as early as possible this month, followed by sunflowers, Sudan grass, manna, pumpkins and cattle melons. Linseed, cowpeas, teff grass, oats, Sunn hemp should be planted after the other crops are in. Ensilage crops may be sown at the end of the month. When harrowing maize after planting, this work

should be done in the heat of the day when the young plants are flaccid and not easily broken. On lands not yet planted the crop of weeds should be kept down by disc-harrowing. It is a good plan to harrow or disc-harrow immediately before the planter, or alternatively to follow the planter with a light harrow. Treat seed oats for smut before sowing. Use one pint of formalin to 25 gallons of water and steep the bag of seed for ten minutes. Earth up early planted potatoes. Keep a look out for the stalk-borer, and top or otherwise treat affected plants. New lands and old pastures may be broken. as circumstances permit, during December, January and early February, and again ploughed in from May to July. If they carry a heavy crop of grass it should be cut or burnt to enable good, clean ploughing to be done. Sweet potato slips should be planted early in this month. Do not fail to have in a few acres of this valuable crop.

DECIDUOUS FRUITS.

Cover crops may be planted when the rains commence, as recommended under citrus fruits. Summer pruning may be commenced this month. If all undesirable shoots are taken out of the trees, the remaining shoots will receive sufficient air and light to mature. Ripening fruit must be carefully harvested, graded and packed if satisfactory prices are to be secured. Do not gather any fruit when it is wet. Keep all recently planted trees in good condition; the first year's growth is the most important. If the undesired shoots are rubbed off when they first appear, the retained shoots will receive all the nourishment and the tree will then grow to a large size.

ENTOMOLOGICAL.

Maize.—The first half of this month appears to be the best period during which to plant maize for the avoidance of stalk-borer attack—at least in the Salisbury district. Hoe out and remove volunteer maize plants before the new crop is up, as they are liable to be infested with borer, which tends to spread to surrounding plants. Red soils may be baited with chopped Napier fodder or other suitable green stuff dipped in arsenate of soda 1 lb., cheapest sugar 8 lbs. or molasses 1 gallon, water 10 gallons, to destroy surface beetles, snout beetles and other insects which may affect the primary stand.

Tobacco.—The enemies of this crop are in general most active during December, whilst the crop is still in the early stages of growth.

For information regarding tobacco pests, see "Rhodesia Agricultural Journal," January, 1928, or Bulletin No. 665.

In general, poisoned baits may be used against surface beetles, grass-hoppers, crickets and cutworms. Against surface beetles, arsenite of soda 1 lb. in 30 gallons of water used to moisten maize bran is a good bait. Against grasshoppers and crickets the addition of 8 lbs. sugar or 1 gallon molasses to each 1 lb. of arsenite of soda is recommended. Spray with arsenate of lead (powder) 1 lb. in 30 gallons of water against leaf-eating insects and as a protection against leaf miners and stem borers. Transplants may be dipped head downwards as far as the roots in the poison. Discard seedlings infested with stem borer and root gallworm.

Cutworms.—Keep ground around seed beds as free as possible from vegetation, to prevent female moths from laying eggs there. From the time the plants show foliage of the size of a sixpence they should be sprayed weekly with arsenate of lead (powder) 1 lb. to 30 gallons of water. This should prevent cutworms developing in the beds, as the young cutworms attack the leaves of the seedlings, and so ingest the poison.

House Flies.—With the coming of hot weather and the rains, house flies greatly increase, and should be kept out of dwelling houses by

mosquito netting, or poisoned in the following way:—Dissolve 1 lb. of sodium arsenite in 10 gallons of water, and add about 10 lbs. of cheap sugar (2 gallons of treacle) or other sweet substance. The mixture should be sprayed upon branches of shrubs or trees, which may be hung up in convenient places where flies congregate. These insects are attracted to the bait, and are easily poisoned.

Mosquitoes, Stable Flies.—Destroy breeding places around homestead. Poison or trap adults.

Potatoes.—Ladybirds and caterpillars may be injurious to the foliage, and on sandy soils blue blister beetles sometimes cause damage. Spray with arsenate of lead (powder) 1 lb. to 25 gallons of water.

Kitchen Garden.—Marrows, etc., are commonly attacked by leaf-eating beetles. Spray with arsenate of lead (powder- 1 lb. in 25 gallons water, plus 8 lbs. cheapest sugar or 1 gallon molasses. Dusting lightly with pure arsenate of lead powder should give protection. Young plants of the cabbage family may be dusted with pure arsenate of lead powder or with such powder mixed with up to six or eight parts of finely sifted, thoroughly slaked lime as a protection against leaf-eating insects.

Fruit Trees.—The regular collection and destruction of fruit beetles may be necessary. Choice varieties of peaches, etc., may be netted as a protection against pests.

FLOWER GARDEN.

This month is generally showery, and constant stirring of the soil is, therefore, necessary to keep it loose. Seeds of perennials and annuals for February blooms may be sown. Transplanting should be done in the evening or on a cloudy day. Carnations should be kept free from dead wood, and climbers attended to.

VEGETABLE GARDEN.

All vegetable seeds may be planted. All advanced plants should be constantly cultivated. Potatoes should be ridged, and peas, beans and tomatoes staked. This is a good month for planting the main crop of potatoes.

FORESTRY.

Final preparations for planting should be made, including harrowing or pitting. Early plantings may be carried out if the season is a good one. Planting should be carried out on dull, rainy days, or failing such days, late in the afternoons. Great care should be exercised in planting out to avoid bending the tap root, and to set the trees in the ground at the same level as they were in the seed bed or tray. Late sowings of Cedrela toona seed may be made.

POULTRY.

The poultry keeper should take precautions whereby the wet weather will not affect his birds' health and their laying powers. All houses must be absolutely watertight, the floor raised well above the level of the surrounding ground, thus preventing water seeping in and making it damp. The birds themselves should not get wet, and no pools of water should be seen in the runs. Foodstuffs also must be kept absolutely dry.

Many birds will at present be moulting; these require special treatment to bring them through it quickly, and if possible keep them in lay during the period. A pamphlet on this can be obtained from the Poultry Officer,

Department of Agriculture. This lack of attention to the birds during the moult is one of the causes of the scarcity of eggs at this season. There is no need for it if poultry keepers would only look after their birds properly.

Those who intend disposing of their turkeys for killing at Christmas must avoid cooping them up, as is done when fattening fowls, for they immediately mope and go off their food. Give them free range, and in addition to their usual evening feed of maize, during the first week of December give one of wheat or maize in the morning. and during the second and third weeks three meals a day, each one containing, in addition to wheat or maize, some crushed monkey nuts or sunflower seeds. Plenty of thick milk and chopped-up onions or onion tops should also be given.

Those who go in for ducks should feed well and get as many to marketable size as possible by Christmas, when they usually fetch good prices. They should be kept in a small run; nearly all their food should be wet mash, bran, pollard, maize meal, meat meal and milk, as much as they will eat three times a day, i.e., they should practically be allowed to spend their existence eating and sleeping. Big duck breeders often give a fourth meal by lamplight at 10 pm., and the first meal is given at sunrise.

STOCK.

Cattle.—Feeding should be continued on the same lines as in November. Keep a close eye on any store bullocks that have been selected for fattening on grass.

Ranching cattle should not require any attention beyond dipping. Every effort should be made to have all the female stock in good condition for the breeding season.

Milch cows should be protected as much as possible from cold rains and hot sun. Yarding at night in a clean kraal provided with a simple lean-to shed well bedded up will be found to be very beneficial in seasons of protracted rainfall. The calf-pen should be kept clean, dry and sweet, and young calves will be better kept in during very hot or very wet weather.

Sheep.—Graze on the higher lands, keeping the kraals clean, dry and airy, and watch for ticks. Take out the rams at the end of the month.

DAIRYING.

During the months of December and January veld grazing is usually plentiful, and very little extra feed in the form of concentrates is required for dairy stock. It should be borne in mind, however, that heavy milking cows are unable to satisfy their requirements for milk production from veld grazing alone, and should receive a daily allowance of grain; the latter should be fed at the rate of 2 lbs. for every gallon of milk produced daily, i.e., a cow producing three gallons of milk should receive 6 to 7 lbs. of concentrates. An excellent mixture for this purpose is one consisting of four parts maize meal and one part ground-nut cake.

During wet weather, the provision of a clean dry shelter for calves is essential; the latter should not be crowded together in a small, damp, badly ventilated pen or muddy kraal. When treated in this manner, a calf is very liable to contract various ailments such as scour, etc. Scour is entirely preventable, and is usually caused by over feeding, or feeding from dirty pails, feed boxes, etc. Calves which contract scour should be isolated, the milk ration reduced, and they should be dosed with a few tablespoonfuls of castor oil.

Under the weather conditions which now obtain, cream should be despatched to the creamery at least three times a week. It is of the greatest importance that cream should be cooled immediately after separation, and should be kept cool while on the farm and whilst in transit to the railway station or siding. While the cream is being cooled, it should be frequently stirred, using a stirrer with a plunger attachment. Warm, freshly separated cream should not be mixed with old cream which has already been cooled. Cool the fresh cream first and then mix thoroughly with the old cream. Gassiness is a common defect in the cream received at the creameries at this time of the year, and is caused by gas-producing organisms with which the milk and cream are contaminated. These organisms abound in mud, manure, etc., and develop and multiply very rapidly at high temperatures. Any precautions therefore which may be taken to eliminate dirt, manure, etc., from the milk and to keep the cream cool will prevent the development of gassiness.

As the night temperatures are fairly high, cheese-makers should not attempt to use night's milk for cheese-making; morning's milk plus a starter will give the best results. Gouda cheese-making operations are not usually successful at this season of the year, owing to the poor quality of the milk and the prevalence of gassiness. This type of cheese is best manufactured during March and subsequent months.

TOBACCO.

Continue preparation of land. The best results are obtained by transplanting on well prepared soil. Transplanting should be pushed on with as fast as transplants and climatic conditions will allow. As soon as plants begin to grow, go over the field and fill in all missing hills with strong selected plants, and then apply fertiliser to hasten growth and ensure early maturity. Cultivation should be commenced as soon as the plants start growing, especially on sandy soils. The crust caused by heavy rains should be pulverised through cultivation as soon as the surface soil is dry enough for tillage; this gives the young plants the benefit of the moisture stored in the soil. Do not neglect the late sown seed beds. Make every effort to finish transplanting before the end of the month, so that the crop will be harvested before dry, cool weather begins.

VETERINARY.

Occasional cases of horse-sickness may occur during this month. With the great increase in ticks, due to the heat and moisture, cases of redwater and gall-sickness may be expected, more especially amongst Colonial stock imported since the last rainy season. The cool weather which frequently follows the early rains is an excellent time for castrating calves and other animals.

WEATHER.

In Mashonaland the rainfall during this month varies from eight inches along the eastern border to six inches in the west. In Matabeleland it varies from five-and-a-half inches in the west to four-and-a-half inches in the south. Considerable divergencies from these normals may occur in individual seasons, but on the whole this month is the most regular in its behaviour. Very heavy downpours may be looked for, and it is well to be provided by drains and ditches against the effects of very heavy rain storms. A dry spell about Christmas time is a very frequent, though not invariable, event in Rhodesia. This partial drought may last only a fortnight, or may extend to six weeks, in the latter event often causing some anxiety regarding young crops, especially those not yet through the ground. The best means of meeting this condition of the weather is by frequent surface cultivation by harrow or horse hoe to preserve a loose soil mulch on the surface and prevent losses of soil moisture by evaporation.

Departmental Bulletins.

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6o. 709. Sand Veld Farming and its Possibilities, by E. D. Alvord, M.Sc. (Agr.).
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TOBACCO.

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Handbook of Tobacco Diseases in Southern Rhodesia, by J. C. F. Hopkins, B.Sc., A.I.C.T.A. Price 3/6 post free from Accountant, Department of Agriculture, Salisbury.

LIVE STOCK.

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Editorial.

Contributions and correspondence regarding subjects affecting the farming industry of Southern Rhodesia are invited. All communications regarding these matters and advertisements should be addressed to:—The Editor, Department of Agriculture, Salisbury.

A Special Shipment of Stall-fed Steers for the Overseas Christmas Market.—The experiment started at the Matopo School of Agriculture on August 2nd on the feeding of chillers for the Overseas Christmas Market is now completed. The animals were slaughtered at the Rhodesian Export and Cold Storage Co., Ltd., on November 12th, and from the 150 stall-fed steers a special parcel of 400 quarters were selected and specially prepared for the Overseas Christmas Market.

These will be displayed at the Smithfield market as a special exhibit of Rhodesian Chilled Beef, in order to demonstrate what it is possible to do by stall-feeding. The standard will probably be higher than that of the average run of stall-

feds, which could be produced in the Colony during the next few years, but it will set a standard to work up to. The Senior Animal Husbandry Officer, who has recently returned from London after a thorough investigation of the Chilled Meat market, has emphasised the importance of increasing the proportion of stall-fed cattle if the industry is to prosper.

The prices realised overseas, together with the data on feeding and management, should give the feeder useful information to guide him in his feeding operations next year. A detailed report on this will be published at the conclusion of the trial.

Facilities for conducting the trial were provided by the Rhodesian Export and Cold Storage Co., who supplied the animals, and who are bearing the cost of the feed used. The Maize Control Board assisted by supplying maize at a reasonable figure. The Matopo School of Agriculture is responsible for the actual feeding and management of the animals.

Arrangements have been made to advertise the shipment in London, and the feeding and slaughtering process have been filmed by the African Theatres, and will be featured as an item in the "African Mirror."

Blackhead Sheep in Matabeleland.—In this issue an article by Mr. C. A. Murray outlines clearly the lines on which mutton sheep should be produced in Matabeleland. The great importance of a good ram, proper culling, supplementary feed and regular dosing is emphasised. With the intelligent application of these methods, the Blackhead can be farmed successfully in Matabeleland, at any rate, on a reasonable scale.

It cannot be said that the sheep industry is firmly established in this Colony. A good deal of progress has been made on the Eastern Border, but the general experience in

other areas has been that the sheep do well to start with and in small flocks but, as the numbers increase, parasitic troubles multiply and the flock no longer thrives.

To a large extent farmers in this Colony are cattle minded and neglect their sheep. This lack of care and knowledge is at the root of much of the trouble and is unfortunate, as a small, healthy flock is a very profitable side line.

The Colony is not self-supporting in the matter of sheep. From 1930-1931, the number of European-owned sheep decreased by approximately 5,000 head and, in the year prior to the outbreak of Foot and Mouth Disease, the importation of slaughter sheep from the Union amounted to 30,000 head. Local butchers complain generally that fat lambs are almost unobtainable. So far they have usually paid satisfactory prices for good sheep, and producers can look forward in confidence to a good market for well finished slaughter sheep for some years to come. After that the prospects for export are not discouraging.

Export of Frozen Porkers.—It has been decided to export a trial consignment of Frozen Porkers to Smithfield Market, London, in the near future.

The prospects for the export of frozen porkers from this Colony are considered sufficiently promising and arrangements have been made for the preparation, transport and sale in London of an experimental consignment. This trial should give valuable data in regard to the suitability of the best type of porkers raised at present locally for English trade and should prove a good test of the efficiency of the transport and preparation facilities available.

The organisation of the consignment will be undertaken by the Department of Agriculture in co-operation with the Rhodesian Agricultural Union, the Matabeleland Farmers' Co-op. and the Rhodesian Cold Storage and Export Company. When Dr. A. E. Romyn, Senior Animal Husbandry Officer,

was in London recently, he arranged for three pigs, selected from a New Zealand shipment, to be sent out to demonstrate the type required and the methods of dressing, preparation, etc. We now learn that these have been sent and are expected to arrive early this month.

One hundred and twenty porkers are required of approximately 100 lbs. liveweight each (range 90-110 lbs.) and fed on approved lines. It is intended to select pigs of three or four typical crosses or breeds, both black and white. The porkers will be the best type produced locally in commercial quantities, but pigs fed or bred on exceptional lines will not be taken as far as possible. The different lots will be marketed separately.

The Department of Agriculture will purchase the pigs outright from farmers at the ruling price for porkers of the quality concerned and arrange for the slaughter of the pigs at the Rhodesian Cold Storage and Export Company in Bulawayo, which is actively assisting in the experiment.

Any farmers interested in the experiment, or who desire to send pigs, should communicate with the Secretary, Department of Agriculture, Salisbury, or with the respective secretaries of the Rhodesian Agricultural Union or Matabeleland Farmers' Co-op. All pigs will be inspected by an Animal Husbandry Officer of the Department before they are accepted and, as far as possible, it is intended to collect pigs in the vicinity of Bulawayo or Salisbury so as to save expense.

The report of the Chief, Division of Irrigation, for the year 1932 appears elsewhere in this number. It will be noted that measures to prevent soil erosion are receiving a good deal of attention, and it will be of interest to many readers that further action has been taken since the report was written.

A special committee was appointed by the Rhodesia Agricultural Union to enquire into this most important subject, and at the recent Congress a permanent committee was appointed for the furtherance of the work.

Through the generosity of Messrs. Newmarch and McLean a soil erosian research station has been established on Glenara Estate.

Experiments have been planned to test:—

(*a*) The relative efficiency of contour ridges on two different grades.

(*b*) The total normal run off for each ridge.

(*c*) The rate of run off from varying intensities of rainfall.

In addition, it is hoped that information may be available as to the humus and chemical content of the silt held behind the ridges and of the silt carried away.

Southern Rhodesia Egg Laying Test, 1934-1935.—The next test will commence March 1st, 1934. Entries close 15th January, 1934. Full particulars, rules and entry form can be obtained on application to the Chief Poultry Officer, Department of Agriculture, Salisbury.

Single pen accommodation is provided. Intending competitors are requested to make early application.

Committee of Agricultural Enquiry.—The Government has decided to appoint a Committee to enquire into and report on the economic position of farmers and the farming industry of the Colony.

The personnel of this Committee will be as follows:—Chairman, Mr. Max Danziger, J.P., of Gwelo; Mr. W. Brown, J.P., of the South African and General Investment and Trust Company, Salisbury; Mr. J. M. Milne, of the Standard Bank, Salisbury; Mr. R. W. Arthur, of Salisbury; and Captain F. Harris, of Bulawayo.

Mr. J. H. Hampton, Department of Lands will fill the position of Secretary to the Committee.

The terms of reference are as under:—

(1) To review the farming position of the Colony in general, and suggest measures which might be taken to enable farming to be conducted more profitably with a view to securing to the producer a return more in keeping with reasonable costs of production.

(2) To consider whether it would be practicable and advisable to regulate supplies of certain farm produce to the requirements of internal markets in cases where a surplus is at present produced or to suggest improved arrangements for the disposal of such surplusses.

(3) To make recommendations as to the measures which might be adopted to alleviate cases where farmers are overburdened with mortgage or other debts and to suggest re-adjustments which will bring the former of these liabilities into closer relationship with farm earnings.

(4) To review and advise on the agricultural credit system of the Colony, including the practice of giving cessions of and stop orders on crops.

(5) To indicate forms of relief which might be adopted, the channels through which assistance should be given and the conditions in regard to such assistance which should be imposed.

It is anticipated that a preliminary meeting of the Committee will be called for the 5th of this month and that regular sittings will commence about the 11th.

Department of Agriculture and Lands.

NOTICE.

The following extracts from the Locust Destruction Ordinance, 1918, are published for the information and guidance of the public:—

2. (1) Whenever locusts deposit their eggs or hoppers appear on any land, the occupier thereof shall, with reasonable speed, give notice thereof in writing or otherwise, to the nearest Magistrate or at the nearest police station.

(2) In that notice he shall state as nearly as may be the locality where the eggs have been deposited or the hoppers have appeared, and such other particulars as may be prescribed by regulation.

(3) For the purposes of this and the succeeding sections the occupier of land which is in a native reserve shall be the head of the kraal in respect of all land pertaining to such kraal, and the notice required by this section shall be given to the headman of the section or the chief of the tribe, who shall immediately report the facts notified to the Native Commissioner of the district.

3. (1) On receipt of any such notice the person to whom the notice is given shall transmit the import thereof to the Department.

(2) The said Department may, by its officers, take such steps for the destruction of the eggs deposited or the hoppers as it may deem advisable or as may be prescribed by regulation.

4. Every occupier of land on which hoppers appear shall, in addition to carrying out the duty imposed upon him by

section two, cause the hoppers to be immediately destroyed. Material for such destruction shall be provided free of charge by the Department; provided that such material shall be deemed to have been provided when delivered by the Department at the nearest Magistrate's or Native Commissioner's office or police station.

5. Any occupier of land who drives or causes to be driven or attempts to drive or knowingly permits the driving of hoppers from his land on to the land of his neighbour shall be guilty of an offence, unless he prove to the satisfaction of the Court that growing crops on his land were being threatened by the hoppers, and that in driving them away he took all possible steps to destroy them and did not drive them towards growing crops of his neighbour.

H. G. MUNDY,
Secretary, Department of Agriculture and Lands.

Plate I.—Some prize-winners bred by John E. Biggs and Son, Graaff Reinet.

The Blackhead Persian
ITS BREEDING AND MANAGEMENT IN MATABELELAND.

By C. A. MURRAY, M.Sc., Lecturer in Animal Husbandry, Matopo Estate.

Origin.—Whereas the ordinary "Kaffir" or "Native" sheep and the fat tailed Africander sheep are indigenous to South Africa, the Blackhead Persian is not. It belongs to the fat-rumped sheep of Asia and North Africa, and particularly to that group found in Arabia and Somaliland.

Mr. Montague Gadd, the oldest breeder of Blackhead Persians in South Africa, describes the early introduction of the breed as follows: "About the year 1865 a disabled sailing vessel put into Port Beaufort, a bay on the Swellendam Coast. The late Messrs. Barry and Heatlie happened to visit the boat, and, being farmers, were interested in three blackhead ewes which had been loaded at Aden, in the Persian Gulf, as butcher's stock for the use of the crew. They managed to secure the three ewes in exchange for other suitable slaughter sheep and sent them round to Cape Town and from there to Worcester, the railhead in those days, and from there by ox-wagon to their farm Glen Heatlie in the Robertson district. Two of the three ewes were fortunately in lamb and one lambed twin ewe lambs and the other a ram lamb. From this lucky venture most of the Blackhead Persians in South Africa to-day have sprung."

In 1895 Mr. Gadd secured Mr. Heatlie's entire flock, who had by then acquired Mr. Barry's share.

Mr. Gadd further states: "In about 1903 an importation was made by a Mr. Barry, but they were very inferior to the animals we had then bred in the country. In competition with locally bred sheep at a Port Elizabeth Show shortly after the Boer War not one secured a prize."

"A few years ago a Blackhead Persian enthusiast wrote to agents for a photograph of the best Persian sheep procurable

with a view to importing some with the object of introducing fresh blood into his flock, but the result was very disappointing. The photograph, taken of two sheep standing on a beautiful Persian carpet, was of two wretched animals, not to be compared with the South African Blackhead Persian of to-day."

The Blackhead Persian is recognised as a pure breed of sheep, and since 1906 registrations have been effected in the South African Stud Book.

As regards the distribution of the breed, Blackhead Persians of South African origin, are to-day found in large numbers in the British West Indies, Kenya, Tanganyika, Belgian Congo, Portuguese East Africa, Northern Rhodesia, Southern Rhodesia, Bechuanaland, South-West Africa and the Union of South Africa.

BREED CHARACTERISTICS.

Standard of Excellence.—The following is the Official Standard of Excellence and Scale of Points of the Breed:—

	Maximum Points.
1. *Head and Neck*—to be of black colour, with black running evenly round the neck, black to extend no further than the neck, bag under neck well developed, large and hanging...	10
2. *Tail*—well-defined, well up to the back, full, firm and square, and not hanging sloping downwards. The second joint not too large nor coarse, to be firmly set against the main tail in a backward position, the small joint being on a level with the back. The third joint to hang perpendicularly and not too coarse. Tail to hang true, *i.e.*, not one one side	20
3. *Symmetry*—back broad, deep at girth, good brisket, short, straight legs	30
4. *Weight and Size*	30
5. *Coat*—strong, smooth and without wool	10
	100

Disqualifications.—White spot on head, horns, wool or black on body, visible white spots on black skin of tail; grey colouring on the tail or legs of a two tooth sheep (a few grey hairs on the tail or legs of a four tooth or older sheep need not necessarily disqualify).

General Description.—Professor Duerden, of the Rhodes University College, Grahamstown, who has made a close study of the breed, describes it as follows:—

"The *body* is compact in form, combined with good depth, the length being accentuated by the brisket in front and the cushions of fat behind.

"The *head* is short and medium in size. The crown is raised and polled, while the *eyes* are large, bright and prominent, and golden yellow in colour. The *nose* is moderately Roman, and on either side are swellings of fat, as also behind the ears. The *nostrils* are large and wide and the mouth well-shaped, an overhanging lower jaw being avoided. *Horns* are never developed, but between the eyes and ears are sunken hollows in the places they usually occupy. The *ears* are moderately long, thick, leaf-like and tapering. They are actively carried and usually held horizontally, although moving freely forwards, backwards and downwards, flexibility being a marked feature. Unlike the rest of the coat, the ears are smooth and silky to the touch, covered only with fine short hair.

"The *neck* is thick and well-set with heavy muscles, the skin showing a slight tendency to wrinkle. The *dewlap* extends from just behind the chin to about half-way down the neck, and in the ram bears a mane of long fine fibres. It is variable as regards its length and depth, and in well-fed sheep is heavy with fat.

"The *chest* is broad and deep and the shoulders wide apart, allowing for full development of the vital organs. The

brisket is remarkably well developed. As seen from the side it gives a square effect, being vertical in front and horizontal below for some distance, extending well in front of the fore legs. Viewed from the front it is very broad, nearly filling up the space between the legs, the thickness being largely due to a deposit of firm fat.

"The *shoulders* fit neatly against the body without any bony projections. The *withers* merge insensibly into the shoulder tops, and are approximately level with the hips, presenting a smooth firm surface.

"The *ribs* are well sprung from the back, curving round evenly and projecting somewhat beyond the fore and hind quarters. They are smoothly covered with flesh and only discernible on handling.

"The *loins* are moderately broad in well-bred animals, and the outline of the back is straight. When unimproved the back is curved, showing a marked depression in the middle. The *hips* are slightly raised and rounded, although the actual bones are not prominent.

"The *rump* is broad and well developed, and the muscles are covered by the thick pad of fat extending from the tail.

"The *buttocks* are well developed and very prominent, since they are covered by thick pads of fat, which hang below the tail and are firmly applied to the thighs, joining the two for some distance.

"The *hocks* are strong, and when viewed from behind are straight and squarely placed, showing good width between the legs. In badly bred animals the hocks are often close together, the animal being said to have cow hocks. This is undesirable, since the sheep cannot walk so easily, nor cover so readily the long distances sometimes necessary for grazing. The *joints* are strong, but do not project in an unsightly manner.

"The four *legs* come off from the body squarely. In comparison with the Merino they seem longer and thinner, the appearance being due to some extent to the absence of wool. The *hoof* is always black, being deep and of a neat appearance, with no tendency to spread.

"The *rump and tail* are distinctive features of the Blackhead Persian. The appearances are at first difficult to interpret, and call for detailed description. The tail is separated into three distinctive parts, known to the breeder as the first, the second and third tails, or first, second and third joints. The first two are mainly swollen masses of fat, and conceal the tail proper, while the third is short and slender like the tail of animals generally. The second tail is curved upwards and forwards and rests upon the first, while the third is drooping and rests upon the second."

Adaptability.—Because of its inherent hardiness, and natural resistance to tickborne (heartwater) and other diseases (blue tongue, etc.) the Blackhead Persian is exceptionally well adapted to Matabeleland conditions. During the summer months they accumulate large amounts of fat over the rump and in the tail and this acts as a reserve on which they draw during periods of scarcity. They are able, therefore, to subsist on very scanty vegetation and survive long periods of drought.

Suitability for Mutton Production and for Crossbreeding.—The Blackhead Persian is not considered an ideal mutton sheep on the overseas markets chiefly because of the uneven distribution and the wastefulness of its fat. However, very encouraging reports have lately been obtained from the trade on experimental consignments of frozen lamb carcasses (pure Blackhead Persian and first cross lambs from Blackhead Persian rams and Kaffir ewes) exported from the Union of South Africa to the Smithfield Market.

The mutton from the Blackhead Persian and its crosses is of good quality, tender and has a very nice flavour. On the South African and local markets it is in great demand and fetches a very substantial premium over the ordinary Kaffir and Merino sheep.

In addition to the better quality of the meat the Blackhead Persian matures earlier than the Kaffir sheep, and crossed with Kaffir ewes produces earlier maturing, better quality lambs.

The following table give some figures on the rate of maturity of pure Blackhead Persian lambs, and first cross lambs out of Kaffir ewes by Blackhead Persian rams.

Flock.	Breeding of Lambs. 1st Cross	Locality.	Average age.	Av. Weight per Lamb.
A (1)	Blh. P. X Kaffir	N. Transvaal	8½ months	60lbs.
B	,, ,, ,,	,, ,,	7½ ,,	58 ,,
C	,, ,, ,,	,, ,,	8½ ,,	57 ,,
D	,, ,, ,,	,, ,,	7 ,,	49 ,,
E	,, ,, ,,	Matabeleland	7 ,,	49 ,,
F	Pure Blh. P.	N. Transvaal	7 ,,	51 ,,

Management.—The Blackhead Persian responds to good treatment as well as any other breed of sheep. To get maximum returns and satisfactory results a careful and intelligent system of management should be followed. Furthermore, in the control of internal parasites management plays as important a part as medicinal treatment.

Rams.—Good type pure bred rams should always be used. Grade rams or rams showing poor quality and lack of constitution and development should never be used.

It is advisable to use two rams per hundred ewes.

At mating time the rams should not be allowed to run with the ewes continually. Much better results will be obtained if they are kept at home in some shady place during the hot part of the day, fed a little bean hay and mealies to keep up their condition and vigour, and put with the ewes from the cool part of the afternoon until the next morning.

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(1) Figures given for flocks A, B, C, D and F were obtained from experiments carried out by the Union Department of Agriculture at the Pietersburg Experiment station (N. Transvaal) and in co-operation with a large number of farmers in different parts of the N. Transvaal bushveld. Figures for flock E are of lambs bred and reared by Major Hoaten, Galawater, Matopo South.

If good results are to be expected the rams should be in good vigorous condition at serving time. From 6 to 8 weeks before the serving season commences they should therefore be fed some supplementary feeding. From $\frac{1}{4}$ to $\frac{1}{2}$ pound of maize per day and some bean hay will be excellent for the purpose.

Before the rams are put to the ewes all old ewes and other poor type and undesirable females should be culled from the flock and kept separate.

Lambing.—Local and seasonal conditions will determine when it is best to let the ewes lamb. In Matabeleland autumn and winter lambs definitely do better than spring or summer lambs. Best results will be obtained, therefore, if the ewes are bred from 1st November on and the rams taken out towards the end of December or middle of January. Furthermore, by breeding the ewes just after the rains during the flush season bigger lamb crops will be obtained than if they were bred during the dry season.

It is common practice in Matabeleland to run the rams with the ewes throughout the year. The inevitable results are that the ewe lamb during the wrong time of the year, lamb throughout the year and usually twice per year, and the young ewes are bred long before they are sufficiently developed. In addition the rams are *very* often bred to their own progeny. These practices are the main causes of the deterioration in size of the sheep and the farmer usually blames the ram instead of finding the fault nearer home.

Shortly before lambing commences the big udder ewes should be separated from the rest of the flock and run separately until the lambs have been weaned. Under such conditions the lambs will do very much better.

Green Feed.—As much green grazing or other succulents as possible should be provided for the lambing season. Under irrigation barley, oats, rye and lucerne do very well. The last three feeds may also be grown successfully in wet vleis during the winter months. Under dry-land conditions "Old Man" Saltbush, which has done very well at the Matopo School of Agriculture, is recommended. A stack of legume

hay (Kaffir beans, cowpeas, dolichos beans, etc.) and some pumpkins and majordas will be of considerable value during and after the lambing season.

It is very important that the lambs should grow well from birth onwards and never be stunted. This can only be achieved if they receive either separately or through their mothers the necessary nourishment. Provision should be made, therefore, to supply it.

Castration and Docking.—Ram lambs not intended for breeding purposes should be castrated at from 2 to 4 weeks of age and *not* be allowed to run until they are from 6 to 8 months old. If properly used the burdizzo will give satisfactory results. It is always advisable, however, to go through the lambs again a month or so later in case a few were missed or not properly done. In areas where screw worm is not troublesome an ordinary knife may be used and will give very satisfactory results. Always use a clean knife and avoid doing the operation in dirty kraals.

It is not necessary to dock the tails of Blackhead Persian lambs and/or their grades.

Weaning.—This will depend on the season and the development of the lambs. Good, strong lambs should be weaned at from 4 to 6 months of age. It is very bad practice to allow the lambs to run with the ewes until they are naturally weaned.

Immediately after weaning care should be taken that the lambs do not receive a setback. Provision should be made, therefore, to have supplementary feeding, including succulents, available for the lambs at and after weaning. The value of bean hay, saltbush, majordas, etc., is again stressed. It has been emphasised before that the lambs should grow continuously from birth onwards. Once they receive a setback they *never* recover from it.

Paddocking and Kraaling.—The question of sheep or vermin proof paddocks does not appear to be economically possible, and in many cases it will be necessary, therefore, to practice a system of herding by day and kraaling by night. Where this latter practice has to be followed it should be emphasised

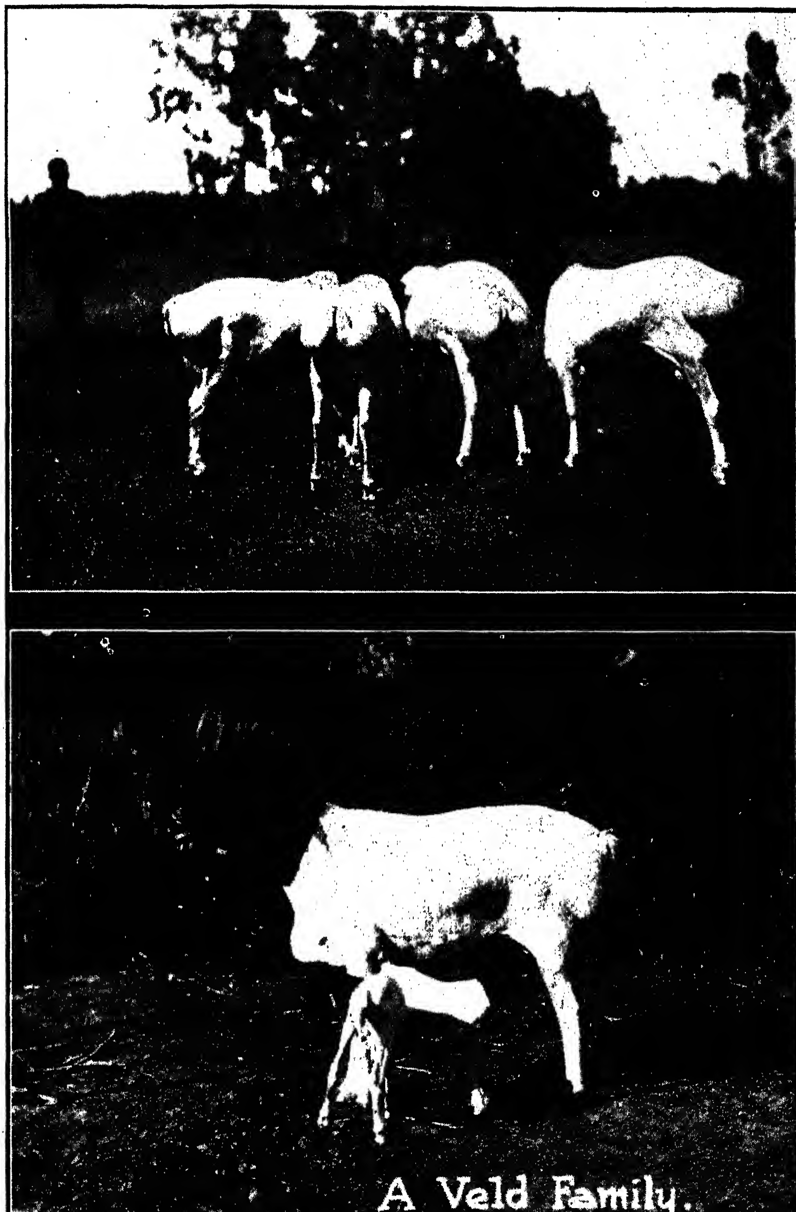


Plate II.—A. Rams suitable for grading up.
B. Twins.

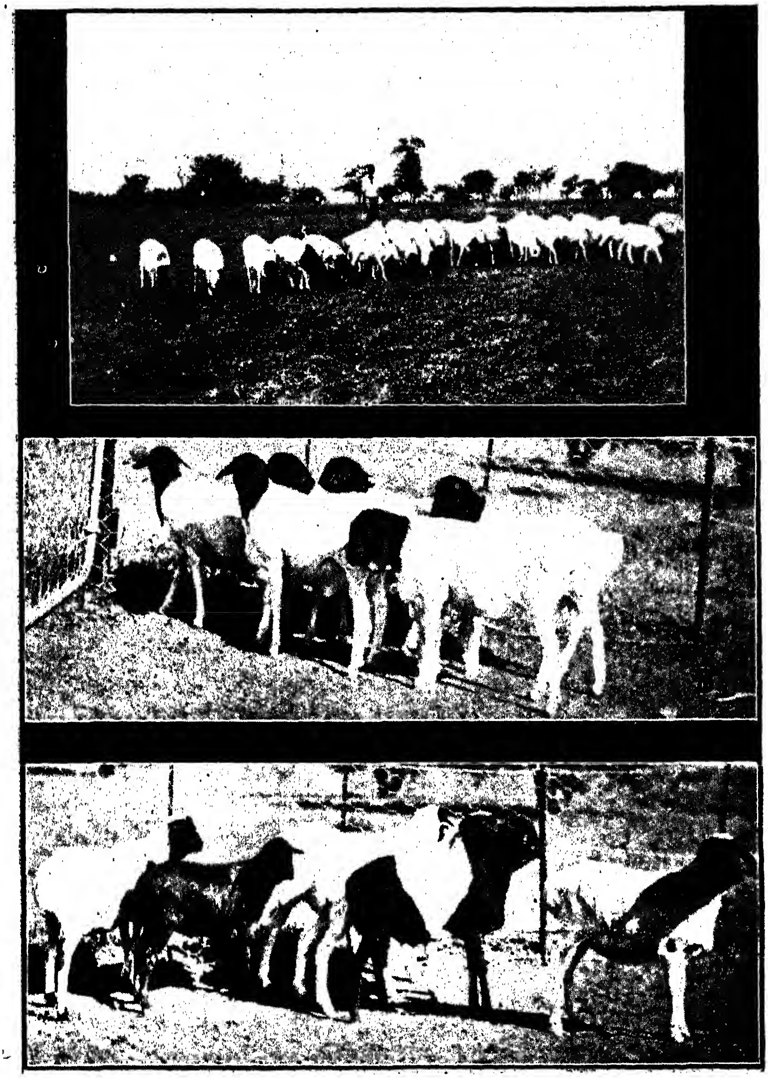


Plate III.—A. Grade lambs on Major Hoaten's farm, Matopos.
B. Pure-bred Persian lambs six months old.
C. First cross with Kaffir ewes, six months old.

that the sheep are sent out to graze as early as possible in the mornings and brought back as late as possible in the evenings. Sheep do not graze during the hot part of the day, but rest and lie in the shade until it is cool and then they start grazing. The writer has often seen sheep only being allowed out of the kraals after 8 a.m. and again kraaled at from 4 to 5 p.m. Under such conditions of bad management it is impossible for any sheep to do well.

Rotative Grazing.—It is not advisable to graze sheep in the same paddock or over the same area year after year. Pastures grazed continuously without being rested become "sheep-sick" and heavily infested with internal parasites. An area grazed one year should, if possible, be rested for at least 12 months before being grazed again.

Further, in order to assist in the control of internal parasites, the sheep should be grazed over the high lying, dry areas during the summer months and not near vleis, dams, etc.

Rotative grazing is an important feature in the control of internal parasites and in successful sheep management.

Water.—Sheep should always have access to clean drinking water. This is very important. Trough water supplied from a windmill is by far the best. Sheep should be kept away from standing water in vleis and dams, as these are ideal breeding places for worms.

Licks.—Well balanced licks assist in the prevention of internal parasites, improve the constitution of the sheep and assist in the prevention of certain diseases such as "Geilsiekte" and "Anaemia."

The following lick is recommended and the quantities given will be sufficient for 100 sheep for one week:—

10 lbs. Bonemeal.
10 lbs. Salt.
10 lbs. Scrap tobacco (broken fine).
2 lbs. Sulphur.
$3\frac{1}{2}$ ozs. Sulphate of iron (Green vitriol).

The sulphur should be added only during the summer months when the grass is green and likely to cause "Geil-

siekte." The sulphate of iron should be given during the winter months when the sheep are thin and in poor condition. It is an excellent tonic.

Dipping.—During the summer months it is essential that the sheep be put through the cattle dip once a week, or once a fortnight. This will assist in the control of ticks and on the whole it will improve the general health of the sheep. In places where ticks are troublesome on the feet of sheep it is advisable to run the sheep through a shallow footbath of dip (ordinary 3-day strength) on their way to the kraal every evening or every other evening.

Control of Worms in Sheep.—During the past few years internal parasites, more particularly nodular worms, wire worms, Hook worms and Tape worms have very seriously affected the sheep in certain areas.

Fortunately definite preventive and control measures are known and from a management point of view the following practices, which have already been mentioned, are very important.

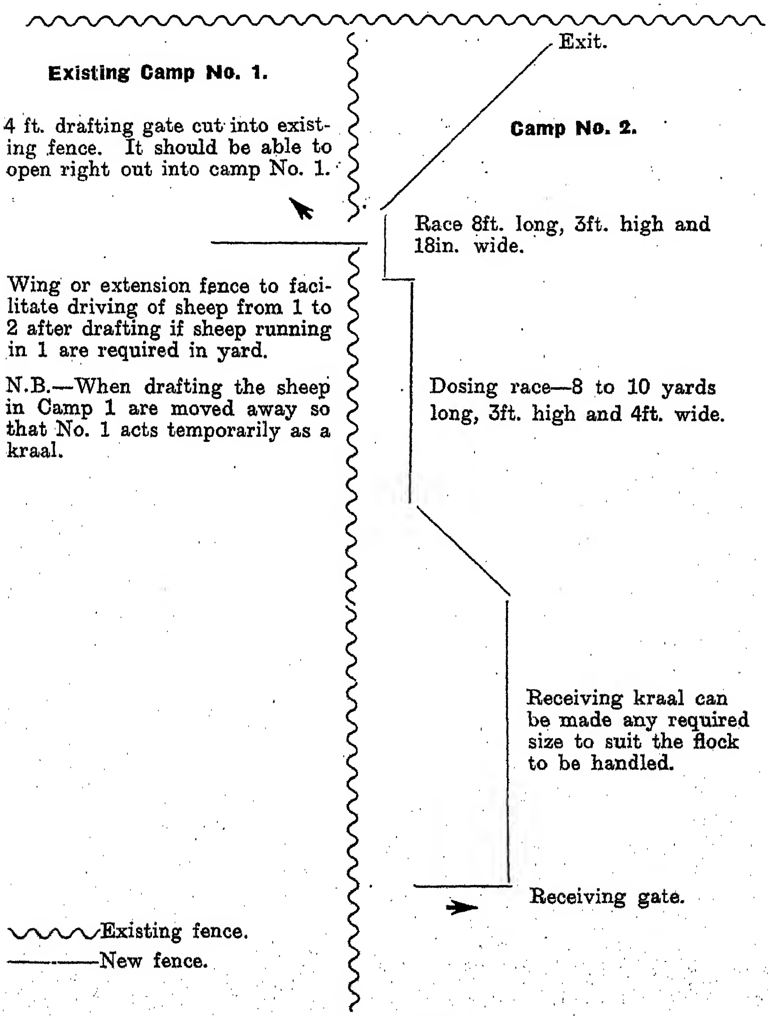
1. The regular dosing to prevent worms picked up since the previous dosing from reaching the egg-laying stage.
2. Avoiding of vleis, dams and other moist places.
3. Rotating the grazing and not overstocking it.
4. Giving the sheep access to a suitable lick.

As regards dosing full particulars will be obtained in Bulletin No. 760, which can be obtained from the Department of Agriculture, Salisbury.

Drafting.—It generally happens when sheep are to be dosed or when certain sheep are to be separated from the rest of the flock that the whole flock is put in a kraal and chased about by a number of natives trying to catch the required ones. This chasing, rough handling and dragging of the sheep is not only very laborious, but cause an enormous falling-off in condition from which the sheep take up to several weeks to recover.

Small dosing and drafting yards will eliminate all this trouble, and it will be possible to dose and draft from 200 to 300 sheep per hour without "punishing" them in the least. In addition, it will effect considerable economy in time and labour.

With all the poles available on every farm suitable yards can be put up at a very small cost.



Dosing and Drafting Yards.

Marketing.—Generally it is *more* profitable to sell the male progeny as lambs 7 to 9 months old and *not* as mature wethers. With April and May lambing most of the lambs should be ready for the market from October to January when prices are high if they have received a little supplementary feeding before and after weaning as pointed out.

Always show the sheep to the buyer in as good and attractive an appearance as possible. It may even be advisable to wash and brush the sheep a few days before they are shown to the buyer.

Conclusion.—The practices indicated in this article will in no way increase the cost of production of the sheep. It will actually lower it by getting and rearing bigger crops of better lambs selling at better prices.

Witch Weed.

Notes by S. D. Timson, M.C., Dip. Agric. (Wye).

Green-manuring with a Trap Crop.—The control of witch weed by trap-cropping is now an established practice in the main maize growing areas, and its efficacy and economy are no longer in doubt. Its efficacy in ridding the soil of witch weed is vouched for by those farmers who have tested it, and its economy has been established by the precise experiments which have been carried out on the Agricultural Experiment Station at Salisbury during the past four years, where it has been proved that suitable trap crops such as Sudan grass and White Kaffir corn are practically as efficient as green manures as Sunflowers and Sunn hemp. This means that the maize farmer may substitute such a trap-crop for the green-manure in his rotation without loss of yield in the following maize crop.

In an article entitled "Witch Weed Control" published in the January, 1933, issue of the *Rhodesia Agricultural Journal* the results of an experiment comparing the green-manure value of Sudan grass (2 crops ploughed under in one season) with that of Sunn hemp and Sunflowers were given.

Below are given the results of an experiment comparing White Kaffir Corn with two strains of Sunn hemp and Sudan grass as green-manures.

The experiment was laid down as a series of five randomized blocks of four plots each. Each plot was 1/20th of an acre, and each treatment was replicated five times, there being a total of 20 plots. The results obtained are shown in the table below:—

Treatment 1931-32.	Mean yields of maize per acre 1932-33. Bags of 200 lbs.
Two crops of Sudan Grass ploughed under	10.52
Two crops White Kaffir Corn ploughed under	12.94
One crop of Tall Sunn hemp ploughed under	12.78
One crop of Short Sunn hemp ploughed under	11.98

The Standard error is .53 bags per acre.

Fisher's Z test shows the results to be significant. Three times the standard error of .53 bags per acre may therefore be considered a significant difference between any two of the mean yields recorded. No fertiliser was applied to either the green manure crops or the maize crops during the period of the experiment.

Discussion.—It will be seen that there is no significant difference in value between either type of Sunn hemp and White Kaffir corn as green manure for maize.

A significant difference is shown between the values of Sudan grass on the one hand and Tall Sunn hemp and White Kaffir corn on the other as green manures for maize in favour of the latter. This is probably due to the fact that weather conditions were unfavourable at the time of germination of the crops, and a poor stand of Sudan grass resulted.

The Sudan grass was sown broadcast at the rate of 20 lbs. per acre and the White Kaffir corn was sown at the rate of 40 lbs. per acre in 3 plots, and at 60 lbs. per acre on the other 2 plots. The Sunn hemp was sown at the rate of 40 lbs. per acre.

It was found that 40 lbs. per acre was a sufficiently heavy rate of seeding for White Kaffir corn. This gave a good cover for the control of weeds. It would appear advisable not to reduce the rate of seeding of a trap-crop of White Kaffir corn below 35 to 40 lbs. per acre to ensure weed control.

The Sudan grass, and White Kaffir corn crops were ploughed under after 2 months growth.

Conclusion.—The great significance of this result is that the maize farmer whose fields are seriously infested with witch

weed can replace his normal green manure crop in the rotation with a trap-crop such as White Kaffir corn, and suffer no diminution in yield of the succeeding maize crop. At the same time he will thereby reduce the infestation of the soil by witch weed to a point where it will be easily controllable by hand cultivation, and do very little damage to the maize crop.

Trap-cropping on the Farm.—Under this heading it is proposed to discuss some of the practical aspects of this method of controlling witch weed.

Method of Sowing.—With the exception of maize, which should be sown thickly in rows as close as will allow effective machine cultivation, all the crops used for trapping witch weed are normally broadcasted for this purpose, though sowing with a cereal drill would no doubt give better and more economical results. If it were found possible to broadcast the Sudan grass, Kaffir corn or Amber Cane on the maize stubble or after merely one disc-harrowing, and then cover it with one disc-harrowing, this would result in a great economy of time and labour. This practice is common nowadays when sowing Sunn hemp for green manuring, but has not, as far as the writer is aware, been tried with the three trap-crops mentioned.

The writer suggests that this method should be tested by farmers on a small scale, and he would be grateful if the results might be reported to him in due course.

Mixing Trap-Crops and Sunn hemp.—A number of farmers have suggested mixing a trap-crop such as Sudan grass or Kaffir corn with Sunn hemp, but the writer cannot recommend this and is definitely opposed to the practice on the following grounds.

The mixing of another crop with the trap-crop seriously interferes with the growth of the latter, and so prevents it from properly doing the work of germinating Witch Weed. At the same time the seed of Sunn hemp is expensive and if it is ploughed under after only two months growth the benefit from using this crop is largely lost.

A mixed sowing of Sunn hemp and Sudan grass was tested on Mr. A. Waddell's farm at Bindura about 4 years ago,

and was found to be unsatisfactory for the reasons already mentioned. It was found that the Sunn hemp smothered the Sudan grass owing to its more rapid growth, and very little Witch Weed was germinated.

One or Two Trap-crops?—Whilst it is undoubtedly desirable to plough under two trap-crops in a season, the practice may require an exceptional stock of ploughs and oxen beyond the normal requirements of the farm.

If only one trap-crop is ploughed under per season it is a simple matter to get over this difficulty by sowing the crop at weekly or larger intervals, so that only so big an area requires ploughing under at one time as can be dealt with comfortably by the normal stock of oxen and ploughs available on the farm. Where it is desired to plough under two crops per season a similar arrangement will assist the farmer considerably to get the work done in time.

Where two trap-crops are to be sown in a season, the first crop must be sown as early as possible to enable the second crop to be ploughed under before the soil dries out. But where one trap-crop only is to be ploughed under in the season it is advisable to postpone the sowing until the latter half of December for several reasons. Firstly, a crop sown at this time is more effective in germinating the parasite than if it is sown before or with the first rains of the season.

Secondly, when sown in late December the farmer is more likely to have good weather conditions for ploughing under the crop.

Thirdly, late sowings will not interfere with the other work on the farm to the same extent.

Seeding Rate for One Crop Heavier.—If only one crop is to be sown in the season the farmer should not stint the rate of seeding, but should sow rather more thickly so as to ensure that the parasite is germinated as efficiently as possible, and that weeds are properly smothered.

Rain Interfering with Ploughing.—If continued excessive rains make it impossible to plough under the first trap-crop before the parasite sets seed, it may be found possible to reap the crop for silage and then plough under the stubble.

If this is not possible then after the crop has been reaped and carted, the witch weed, as it comes into flower, can be hand-picked once or twice until conditions make it possible to plough the stubble under.

When to Plough Trap Under.—Theoretically the ideal to aim at is to plough the whole crop under as the first witch weed plant commences to flower.

In practice this is manifestly impossible, and the farmer must compromise and should keep in mind these two facts; firstly, that the parasite takes approximately three weeks from its first appearance above ground to commence flowering; secondly, it is dangerous to allow more than one week after the first flower appears before ploughing under the parasite.

Thus he can reckon on having one month from the time the first parasites appear just above ground in which to finish the ploughing. Under ideal conditions in a friable soil the parasite takes six weeks from germination of the host to appear at ground level. Therefore, the farmer should *finish* the ploughing under of his trap-crop $2\frac{1}{2}$ months from its germination. He would, however, if he has any considerable acreage to plough, be well advised to commence operations, if possible, at six weeks from the germination of the trap-crop, so as to allow for the possible interference of the weather. This advice applies particularly to the ploughing under of the first of two trap-crops. Where only one trap is planted later in the season (in mid-December say) the danger of interference by the weather is not so great.

Trap-Crops Recommended.—*Sudan Grass*: From most points of view Sudan grass is an admirable trapcrop. The only serious objection to it is that its seed is expensive to buy, and, in the maize belt at least, it is a poor seeder. It should be sown broadcast at the rate of 20 lbs. per acre as a trap-crop.

White Kaffir Corn.—If the proper strains of Kaffir corn are used this crop is as good a host of the parasite as Sudan grass, and in addition seed is cheap and can be bought locally, or alternatively can be grown easily on the farm providing the ravages of 'Smut' disease and birds are guarded against. 'Smut' can be largely prevented by dressing the seed with

12 ozs. of Tillantin powder per 200 lbs. of seed in the same way as maize seed is treated to prevent Diplodia injury to the seedlings.

It is necessary here to reiterate the warning that all varieties of Kaffir corn are not equally good hosts of the parasite. Some, in fact, are markedly resistant to attack by witch weed. Generally speaking, the red-seeded varieties are resistant to witch weed and therefore unsuitable as traps, and the white-seeded strains are susceptible, particularly the dwarf types, and *only white-seeded varieties should be used.*

Before purchasing White Kaffir corn seed it is advisable to make certain that it is a strain which is a good host.

This crop should be sown broadcast at the rate of about 40 lbs. seed per acre. It is essential that a thick stand of plants should be obtained for two reasons: (1) to ensure the maximum germination of witch weed, (2) to ensure that weeds will be kept under control and will not smother the Kaffir corn.

Amber Cane (*Saccharine strain*).—This crop is one of the sorghums, and is intermediate in habit of growth between Kaffir corn and Sudan grass. It has been used in the Union of South Africa for a number of years as a trap-crop for witch weed and has given excellent results.

A quantity of seed was obtained by this Department and distributed for trial to a number of farmers in the Lomagundi, Mazoe Valley, Gatooma and Eastern Fort Victoria districts last season. The chief points it was required to investigate were (1) its suitability to the local conditions, and (2) its seeding ability.

Of the fifteen farmers who tested the crop only one has made a definitely unfavourable report, and his indifferent results are probably best explained in his own words, for he says "the rain fell in torrents for weeks on end without a stop; it was the worst year for rain on record up to the 26th February." None of the sorghums thrive under wet conditions, but are, on the other hand, very drought-resistant crops.

In five other cases the crop failed on account of locusts; drought after germination; being eaten by cattle; or simply neglect, owing to pressure of other work.

The remaining reports are definitely favourable. Seed yields varied from 2.71 bags per acre up to 11.83 bags per acre, which can be accounted very satisfactory considering the bad season, and in comparison with the seed yields of Sudan grass.

It was reported to be very free from pests and diseases, and in particular was not troubled by birds as was the Kaffir corn. One farmer reports that it was not attacked by weevils, although stored next door to Kaffir corn seed, which was severely attacked. The same gentleman reports that it matures three weeks earlier than Kaffir corn.

Three of these gentlemen who have previously used Kaffir corn for witch weed control report that they definitely prefer this crop to Kaffir corn on various counts, including its resistance to pests, particularly birds, and disease; because it is a quicker growing crop and earlier maturing; and because it is a better host of witch weed. In addition it is certainly a superior hay or silage crop to Kaffir corn, *but like the latter it may be harmful to stock when fed green, after a drought or other check to its growth.* It can be fed with confidence as hay or silage.

Conclusions.—To sum up, it would appear likely to prove a valuable trap-crop for witch weed, because it is a good host of the parasite, freer from bird attack and disease than Kaffir corn, and promises to give at least as heavy yields of seed as that crop, whilst only 25 lbs. per acre are needed to sow an acre as a trap-crop as against 40 lbs. per acre in the case of Kaffir corn.

Compared with Sudan grass, it is easier to obtain a good stand in the field, and it is a much heavier and more reliable seeder than that crop. It is not so good a hay crop as Sudan, and as it is slower in growth it does not produce quite the same bulk in the two months of growth allowed it as a trap-crop.

Maize.—The writer cannot recommend maize as a trap-crop for witch weed for the following reasons.

(1) When sown broadcast at an economic rate such as 50 to 60 lbs. of seed per acre, the crop is not able to hold its own against weeds, and in consequence it makes very poor growth.

(2) At this rate of seeding, too, the ground is very poorly covered and it would require a seeding rate at least double to cover the ground effectively to germinate the parasite.

(3) Maize is too slow growing to act efficiently as a germinator of the parasite in the two months allowed for growth.

(4) It cannot perform the work of a green manure crop effectively as the bulk of organic matter it produces in six weeks to two months growth is small compared with the thickly sown Sudan grass, Kaffir corn, and Ambercane, and it does not rot down so rapidly in the soil as the latter crops.

(5) If used as a trap-crop it should be sown thickly in rows about 24-28 inches apart, and should be given at least two cultivations to control weeds. The extra cost of these cultivations is a further argument against its use as a trap-crop compared with the crops mentioned above.

Safety Period between Cultivations and between Sprayings.—Experiments have been commenced with the object of determining how great a period may safely be allowed to elapse between one cultivation to remove witch weed and the next. This hinges on the question how long after the seed capsules have ‘ set,’’ that is, after the flowers have fallen, are the seeds still too young to become viable after the parent plant is cut by cultivation?

It has already been demonstrated by experiments completed this year, that the green unripe seed in capsules still quite green can ripen and mature viable seed on the plant after the parasite has been cut off at ground level. The only difference the early death of the parent plant appears to make is that the seed germinates more slowly than seed which has ripened normally, and its germination capacity is not so high.

It was also found that spraying the plants with 1½ per cent. solution of sodium chlorate, although it killed the plants, did not render immature seed non-viable, although its germination capacity appeared to be considerably impaired by the treatment, and the speed of germination retarded by 3 to 4 weeks.

In view of the available evidence the ‘ safe ’ period between cultivations cannot at present be considered as being

greater than 14 days where the parasite is left on the ground, or greater than 3 weeks when all the parasites in flower are hand-picked and destroyed off the land.

This investigation is being continued.

Control by Spraying.—Unfortunately the arrangements made for the continuance of the large-scale spraying experiments in the Mazoe Valley last season fell to the ground owing to various unavoidable difficulties.

Effect of Green Manuring on Witch Weed Growth.—Many farmers have noted the increase in the amount of the parasites seen above ground on a maize crop following a green manure crop, but there appears to be much confusion of thought on the reason for this phenomenon.

The writer offers his opinions on the subject in the hope that they will help to clarify the position, and the following are the reasons to which he ascribes this undoubted effect of green-manuring.

(1) Green-manuring greatly improves the growth of the maize crop and this leads to an increase in the amount of witch weed appearing above ground in two ways: (*a*) Firstly, the maize is stronger, and so is able to supply more nutriment to the parasites and enable many more to reach the surface of the ground. Where the host plant is weakly or where the soil is heavily infested many parasites are unable to obtain sufficient nourishment to reach ground level. In extreme cases, the host plant may be killed, and yet none of the parasites appear above ground. Secondly (*b*), because the growth of the maize is stimulated the roots develop better, explore the soil more freely and so germinate a greater number of witch weed seeds.

(2) Green-manuring also renders the soil much more friable, and for this reason (*a*) the parasites have less difficulty in pushing their way through the soil to the surface and (*b*) the roots of the host crop can penetrate the soil and develop more freely and so come into contact with a greater number of the seeds of the parasite and over a greater area of ground, thus causing the germination of a greater number of the seeds.

(3) Green-manuring with deep-rooting, thickly planted crops such as Sunnhemp and Sunflowers, the two crops chiefly used for this purpose, leads to a considerable improvement in the subsoil drainage which in turn leads to an earlier, and higher rise in temperature of the soil, which in its turn leads to greater and earlier germination of the seed of the parasite.

Despite the increase in the amount of witch weed seen above ground after a green-manure crop, green-manuring is still a beneficial practice, since it enables the maize to produce a much better yield of grain despite the attacks of the parasite.

However, the best practice is to replace the normal green-manure crop with one or two trap-crops per season. In this way two birds are killed with one stone; the parasite is controlled and the subsequent maize crop benefitted to practically the same extent as by an ordinary green-manure crop, as has been shown above.

In the course of five years' close observation in the field, the writer has noticed a similar increase in the amount of witch weed visible above ground following various crops such as sunflower, cotton, and tobacco, and also where fertiliser or kraal manure have been applied to the land. The same reasons apply in all these cases as are explained under (1) (*a*) and (*b*) above.

Protection of Field from Re-infestation.—The writer is of the opinion that the importance of protecting maize fields lying below infested veld from reinfestation from the witch weed growing there is not sufficiently realised. If there is a piece of infested veld from which storm water runs on to a field carrying the seed of the parasite with it, it is obviously waste of time and money to carry out control measures on that field, unless efficient storm water drains are first dug to protect it.

In any scheme of witch weed control the first matter that requires attention is the protection by storm drains of any fields on to which storm water runs from veld or kopjes infested with the parasite.

A Charcoal Safe or Cooler.

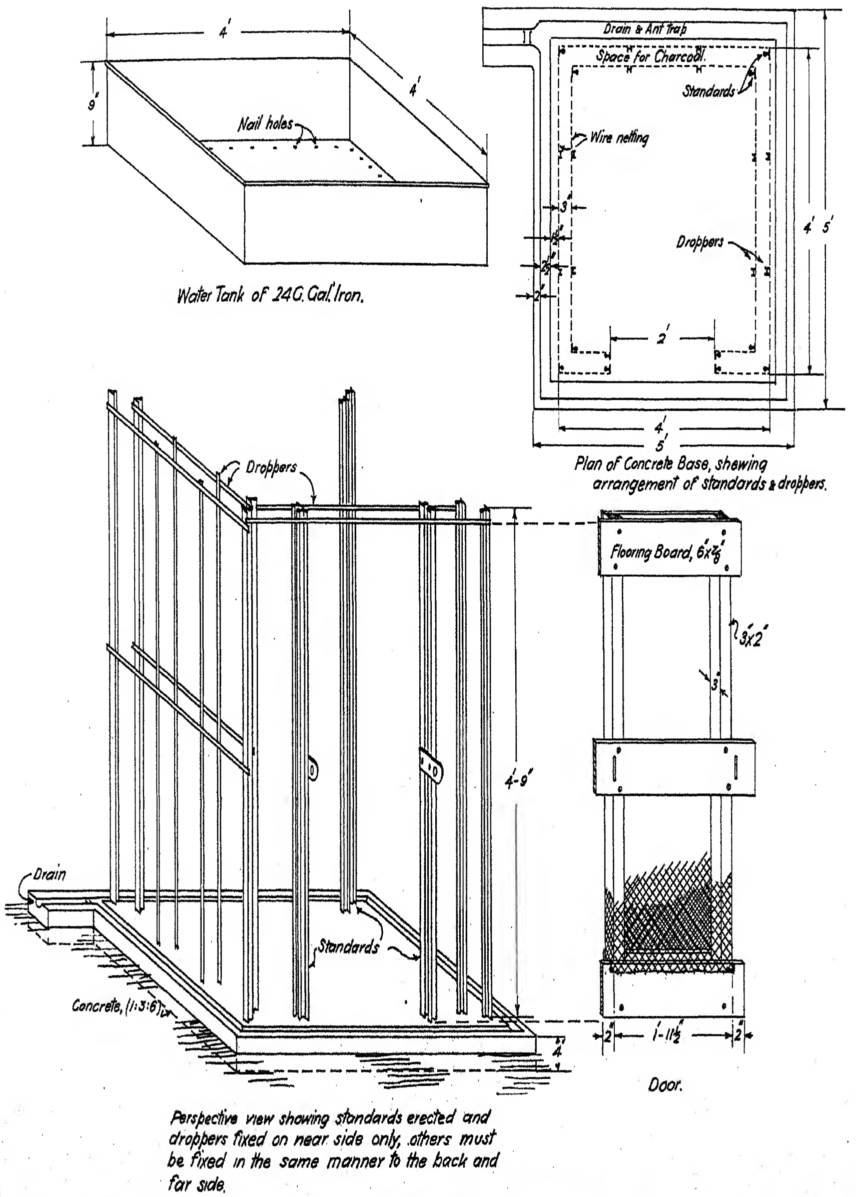
By B. G. Gundry, A.I.Mech.E.,
Irrigation Division.

In our hot season the storage of perishable foodstuffs such as milk, meat and butter, etc., presents a serious problem to many housewives, both in town and country. Various cooling devices such as boxes covered with wet sacks, etc., are made use of, but a more permanent structure is often needed, and this article is written in response to numerous enquiries for information on building charcoal safes.

The working principle underlying this type of cooling device is based on the fact that when water evaporates it absorbs heat from the surrounding air.

Briefly, the safe described hereunder consist of a rectangular chamber with walls made of small pieces of charcoal held between two layers of wire netting three inches apart. Water from a tank overhead is allowed to percolate through the charcoal so that the latter is kept continuously wet. As this water evaporates from the charcoal it absorbs heat from the surrounding air while passing through the charcoal wall into the interior of the safe.

The best site for the safe is in the shade of a large evergreen trees, where it will be exposed to the prevailing wind. If no suitable tree is available a thatched shelter can be built over the safe as shown in the accompanying photograph. The safe should not, for obvious reasons, be placed where it will catch the dust from a nearby road or yard; if possible it should be placed on a small eminence or other well drained site. The site should be cleared of vegetation, and if necessary, levelled off. A shallow excavation is then made 2 or 3 inches deep and 5 feet square. In this excavation eight 12 lb. fencing standards, six feet long, are driven into the ground as shown in the plan, so that they form the corners of two squares,



CHARCOAL SAFE

Irrigation Division.
Salisbury.
B.C.S. 12-11-33.

Photo-Lithographed at the Surveyor General's Office, Salisbury, S.Rhodesia.

one within the other, the inner one having sides 3 feet 6 inches long and the outer one having sides 4 feet long.

Four more standards are driven in on one side to form the door opening, which should be 2 feet wide. Whatever fittings, such as hinges or fastenings, which are to be attached to them, should be fixed before they are erected.

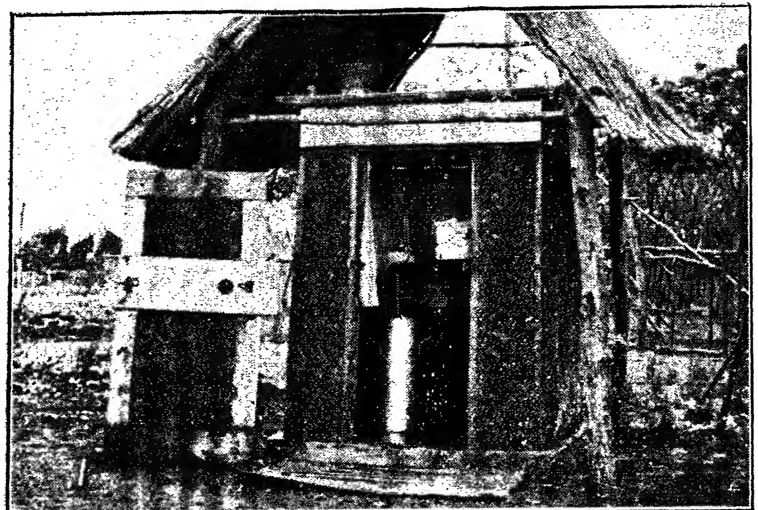
All the standards should be driven in perfectly straight so that they project 5 feet 1 inch from the bottom of the excavation. A spirit level should be used to ensure that they are all set at exactly the same height.

As will be seen from the drawing, twelve "H" section fencing droppers are placed four on each side and four at the back to form intermediate supports for the wire netting. As the droppers are only four feet long it is necessary to use one and a half droppers at each point. The half droppers should be driven in at the positions indicated in the plan and left projecting 1 foot 7 inches from the bottom of the excavation. Whole droppers are then bound on to these as will be described later.

The concrete base may now be poured. The mixture should consist of one part cement, three parts sharp clean river sand and six parts hard clean stone broken to pass through a $\frac{3}{4}$ inch ring. If stone is unobtainable the whole job can be done with cement and sand only, one part of the former to five parts of the latter being used.

The bottom of the excavation should be thoroughly wetted before the concrete is placed. Four pieces of board may be placed round the edge of the excavations to form a frame to retain the concrete until it sets.

The concrete should be thoroughly mixed, first dry and then with just sufficient water to make it workable, and placed in position as quickly as possible; it must be tamped solid and worked into close contact with the standards and droppers. The layer of concrete should be about $3\frac{1}{4}$ inches thick, and as soon as this is in position it should be covered with a layer of cement mortar (1 part cement to 4 parts sand) $\frac{3}{4}$ inch thick.



A Charcoal Safe, as described in this article, recently built by Mr. John Dennis, of "Pendennis," Mount Pleasant.

The surface may be smoothed with a trowel or float, but the centre of the base should be left slightly higher than the edges so that water will not lie in pools inside the safe.

The drain and ant trap must be moulded immediately, before the cement commences to set; this can be done by roughly cutting out a semicircular channel about $2\frac{1}{2}$ inches wide and $\frac{1}{2}$ inch deep with a trowel and finishing it off by rubbing it smooth with a bottle guided by a straight edge. Care should be taken to make the bottom of the channel quite level, as its object is to form a canal, or "moat," round the safe to prevent ants and other insects crawling into it.

At one corner of the base the concrete can be extended a few inches to form an outlet channel to carry any surplus water clear of the base. A small neck should be moulded in this channel over which the water will flow, only when the ant trap or "moat" is practically full.

When the base has been completed it should be covered with sacks or grass and kept continuously damp for at least 3 days to allow the concrete to harden properly.

The next operation is to fix the droppers round the inner square to support the netting on the inner side of the charcoal wall. The vertical droppers are bound to the half droppers projecting from the concrete base with baling wire so that their upper ends are at the same height as the standards. Horizontal droppers are fixed at the top and half way up the sides; a single dropper is placed over the doorway. These are all securely bound to the standards and to each other with baling wire to form a rigid frame work.

This inner frame work is now ready for covering with $\frac{1}{2}$ inch mesh wire netting. This can be obtained in various widths including 3 feet and 2 feet which, if used together one above the other and allowed to overlap by 3 inches in the middle will result in little waste, as the standards project 4 feet 9 inches from the base. Nine yards of each width of wire netting will be sufficient for the job, excluding the door, which will require a further 10 feet of the 2 feet width. The wire itself should be of 20 gauge, as netting made from thinner wire is rather fragile.

The 3 feet wire is wrapped round the inner frame work, one end being brought opposite to one of the inner doorway standards to which it is securely laced with baling wire, the unused part of the netting can be left rolled up near the opposite door standard while the 2 feet wire is being wrapped round above it in a similar manner.

The droppers for supporting the wire on the outside of the wall are now tied in position, the upper horizontal ones being placed about two inches lower than the top of the standards to give access to the wires or thorns which control the flow of the water from the tank, as will be described later. When the droppers are all fixed the wire netting is brought round the outside doorway standards and is wrapped round the outside framing back to the starting point where it is tied to the first doorway standard. The outer covering of wire must be tied at intervals of a few inches to the standards and droppers, and links of baling wire should be passed round the inner and outer droppers every six or eight inches to keep them the proper distance apart.

The space between the inner and outer wire netting may now be filled with charcoal. This should be broken into small lumps from 1 inch to $1\frac{1}{2}$ inches across. All dust and small pieces should be removed by sifting through a $\frac{1}{2}$ inch or $\frac{3}{4}$ inch sieve. (A piece of the $\frac{1}{2}$ inch wire netting can be used for this purpose.) The charcoal thus prepared should be washed in clean water and may then be filled into the walls while still wet. It should be evenly distributed, but need not be packed in too tight.

The door should next be made and fitted, it can be made to lift right out as shown in the drawing or may be hung by two 18 inch Tee hinges, which must be rivetted or bolted to one of the fencing standards forming the door posts. The frame work of 3 inch by 2 inch timber and 6 inch flooring boards is covered on both sides with 2 feet wire netting and filled up with charcoal. The door shown in both the accompanying drawing and photograph is secured by a long locking bar which is passed through the holes in the two projecting plates rivetted to the standards and which project through

the slots cut in the centre cross piece of the door when it is in the closed position. A padlock passed through an eye in the end of the locking bar makes the safe reasonably burglar proof.

It is presumed that the water tank will have been obtained from a plumber. The holes in the bottom should be punched with a 2 inch wire nail from the inside, in straight rows $1\frac{1}{2}$ inches from the edges and 4 inches apart. They should then come exactly over the centre of the charcoal walls when the tank is placed in position, standing on the top of the standards.

The successful working of the safe depends on keeping the charcoal just wet from top to bottom without having a large excess of water running to waste. Unfortunately the regulating of the flow of the water, through the holes in the tank, to the proper speed—usually found to be a fairly fast drip—is not an easy matter. Mimosa thorns and match sticks are frequently used, but these tend to soften and block the holes entirely, and the writer would suggest the use of short lengths of 12 or 14 gauge galvanised wire with their ends bent into loops to prevent them falling out of the holes. Wicks made of soft string should also prove fairly successful.

Any dust or rubbish which finds its way into the tank will tend to choke the holes and make the regulation of the water more difficult, and for this reason the tank should be provided with a lid made of sheet iron or flooring boards.

A hole in the lid to take a fairly large funnel (fitted with a fine gauze if possible) will facilitate the filling of the tank and help to prevent the admission of dust.

A cheap maximum and minimum thermometer kept in the safe will indicate if the safe is working properly and what flow of water gives the best results. Under ordinary conditions the temperature in the safe should not rise much above 60° F.

A single shelf can be supported on the two centre horizontal droppers or a set of shelving can be built independently to fit into the safe.

Should the charcoal become fouled by the use of impure water or other causes it can be removed by untying the outer covering of the wire netting and replaced with fresh charcoal.

The safe can be made larger or smaller than the one described to suit individual requirements.

Timber might be used for the framework, but would probably become rotten in a short time, as it would be continually wet. It should be remembered that the tank when full is a considerable weight, and any lighter type of structure must be sufficiently strong to support it.

The writer is indebted to Mr. John Dennis for permission to publish the accompanying photograph which shows a safe recently built by him on the lines suggested by Mr. J. R. Camp in an article published in this journal in March, 1926, with certain minor improvements which have been incorporated in this article.

Annual Report of the Division of Irrigation.

FOR THE YEAR ENDING 31ST DECEMBER, 1932.

By C. L. ROBERTSON, B.Sc. (Eng.), A.M.I.C.E.,
Chief of Division.

The year under review has been notable chiefly for developments in Matabeleland in that two relatively large earthern storage dams were constructed in that area for private individuals and a policy of constructing weirs for the conservation of water in Native Reserves and Native Purchase Areas has been initiated and eight were completed during the year.

There has been an increased demand by private applicants for the services of the boring machines, mainly due to the number of applications which were received for the development of water supplies on small mining properties.

The demand for advice on soil conservation works has been well maintained.

It is worthy of note that capital expenditure on all these works is still considered justifiable and that advantage is being taken of the ruling low construction costs to instal permanent improvements which in the future will amply repay the expenditure involved.

General.

Acreage of new irrigable land investigated ...	6,052
Total acreage of irrigable land investigated to end of 1932	62,198

The above acreage of new irrigable areas includes 4,785 acres under the Popotekwe Project investigated by the Reconnaissance Survey Party, but not included in previous reports, as the exact figures were not available.

The number of visits paid this year on all matters falling within the scope of the division shows a decrease of 17 on the previous year's total.

The number of visits paid on soil erosion protection advice also shows a small decrease and the area protected is considerably less than in the previous year. This is mainly due to the difficult financial position rendering farmers chary of undertaking any fresh capital outlay.

Meetings of the Committee appointed by the Rhodesian Agricultural Union to investigate the best means for instituting propaganda and speeding up the construction of soil erosion protection works were attended by members of the staff.

Construction work supervised during the year included two earthern storage dams in Matabeleland and eight weirs in the Native areas; three of these weirs were erected departmentally and a saving effected on ordinary contract costs.

The furrow in the Mutema Reserve was also completed during the year and crops are now being grown under irrigation in that area.

Only a few minor schemes for water supplies to Government institutions were supervised during the year owing to the small sum allocated on the estimates for this purpose. Surveys and estimates were prepared in connection with water supplies to various Government institutions, the most important being the one in connection with the proposed native hospital at Mtoko.

Investigations for suitable weir sites were also carried out in the Shashani and Insiza Reserves.

Irrigation.—The number of new minor irrigation schemes advised on favourably during the year have totalled 40 with a potential irrigable area of 1,267 acres and the Popotekwe Project with an irrigable area of 4,785 acres. The probable irrigation development in Matabeleland forecasted in last year's report has materialised in the construction of two relatively large earthern storage dams which are capable of irrigating an area of 125 acres.

These dams are situated on the farm "Paddy's Valley," in the Nyamandhlovu district, and on "Southill Ranch," in the Gwanda district.

The dam on "Paddy's Valley," constructed by a contractor, under the supervision of this Department, has a storage capacity of 175 acre feet with a maximum height of embankment of 34 feet.

The dam on "Southill Ranch" was constructed by the Company owning the property in accordance with plans and specifications supplied by this Department.

It has a storage capacity of 586 acre-feet with a maximum height of embankment of 36 feet.

The object lesson afforded by these two dams will undoubtedly do much to foster irrigation development in Matabeleland, and the initiative of the propreietors concerned in undertaking these projects is to be commended.

The report of the Government Statistician indicates that the area under winter crops (mainly irrigated) in 1931 again shows an increase over that recorded in the previous year, the total being 16,340 acres and 14,249 acres respectively, *i.e.*, an increase of 14.7 per cent.

The area under wheat again showed a very marked increase of practically 25 per cent. over the previous year, *viz.*: 6,911 acres to 8,631 acres, but the average yield still remained at the low figure of 2.3 bags per acre.

Since 1928 the local production of wheat has increased from 6,887 bags to 19,548 bags; this latter figure being just about 20 per cent. of our annual requirements and the limit, therefore, of the local product which millers are induced to buy by the present arrangement whereby a rebate of Customs duties is allowed on every four bags of imported wheat which are mixed with one bag of the local product.

It is to be hoped that the efforts to introduce a variety of "hard" wheat suitable for growth in this country will be successful in order that there may be further expansion in the growth of this crop.

The increase in wheat production is largely due to the extension of irrigated areas, as most of the schemes constructed during the last few years have been for the purpose of growing this crop.

The area under winter potatoes and barley also show substantial increase this year, but the area under lucerne remains still practically stationary at 248 acres.

Soil Erosion.—As previously mentioned, the area protected from soil erosion this year shows a considerable decrease from the record established in the previous season.

The following summary shows the areas protected during the last four years:—

Year.	Miles of contour ridges pegged.	Areas of land protected.—Acres.
1929	76	2,280
1930	103	3,100
1931	150	4,500
1932	108	3,235
Total	437 miles	13,115 acres.

Although these figures are encouraging as an indication of the attention which farmers are devoting to these essential works, yet it will be realised that the rate of progress is too slow when it is considered that there are over 400,000 acres under summer crops in this Colony and that erosion is a serious factor on a considerable percentage of this area.

It was this serious aspect of the matter which induced the Executive of the Rhodesia Agricultural Union to appoint a representative Committee comprising farmers and officials from the Railways and from various Government Departments to investigate ways and means for speeding up construction and instituting propaganda to bring the facts home to farmers.

A valuable report has been prepared which will shortly be submitted to the Government and which, it is hoped, will be efficacious in defining future policy.

One of the recommendations deals with the establishment of a Research Station for obtaining data as to the most efficient spacing and grades of ridges, quantities of silt removed from protected and unprotected lands together with differences in crop yields.

A sum of money has been provided on the estimates for installing this station, and it is hoped that it will be possible to commence operations next year.

Weirs in Native Areas.—The eight weirs constructed under departmental supervision in the Native Areas comprise one in the Gwaai River near Tjolotjo, four in the Godhlawyo Native Purchase area near Filabusi, and three in the Semokwe Reserve.

These weirs are intended solely for conserving water for stock and are usually located in areas in which it has been difficult to obtain underground supplies by boring. The present policy is to construct weirs 6 to 8 feet in height with a storage capacity of at least one million gallons, the impounded areas being fenced and the water delivered to concrete troughs installed in the river bed.

The outlet pipe delivering water to the troughs is fed by a system of "French drains" constructed in the sandy river bed upstream of the weirs, and it is considered that even if the weirs ultimately silt up a supply of water will still be available.

It will be instructive to observe whether the supplies available from these weirs can be regarded as reasonably permanent, and it is possible that some modifications of design may have to be effected in future construction, but in any event the installation of these weirs is a policy which should be encouraged as they will open up, for practically permanent grazing, extensive areas in the Reserves which could formerly only be utilised during the rainy season.

The regime of rivers draining from the Reserves will also ultimately be improved if numerous weirs are constructed on their headwaters and in this way the country generally will be benefitted.

Boring.—Two drills were out of commission for the greater part of the year, but owing to the increase in the number of applications from Matabeleland one of these drills has recently been recommissioned.

A feature of the year's working has been the number of boreholes put down for small mining propositions to provide water supplies to enable mining operations to be carried out.

Supplies in the neighbourhood of 1,000 gallons per hour are usually required in these cases, and it is worthy of record that nine supplies of this order were developed on various properties this year and a material contribution thus made to the success of these propositions.

The drill strength was equivalent to eight drills working for a complete year.

The summary of footage drilled, cost per foot and aggregate yield of water supplied developed is as under:—

Total depth drilled: 14,812 feet.

Footage drilled per working month per drill: 155.1 feet.

Number of boreholes sunk: 119.

Average depth per borehole: 124.5 feet.

Average charge (all boreholes), including casing and depreciation in plant: 17/- per foot.

Aggregate yield of successful boreholes: 940,872 gallons per 24 hours.

Percentage of successful boreholes: 69.4 per cent.

In the following detailed summary is shown the cost of drilling for private applicants, Government Institutes, Native Reserves, etc.

In the case of private applicants, transport, labour and fuel are supplied by the applicant, but in other cases these are supplied by the Government and the cost of these services, together with an allowance for depreciation on the plant, are included in the boring costs.

Private Applicants.

	Farmers.	Miners.	Govt. Institutions.	Native Purchase Areas.	Native Reserves.
Total depth drilled, feet	4,705	2,206	420	336	7,145
No. of drill-months... ...	33	19	3	3	37.5
Footage drilled per working month per drill	142.6	116.1	140.0	112.0	190.5
No. of boreholes sunk ...	40	18*	4	3	54
Average depth per borehole (ft.)...	117.6	122.6	105.0	112.0	132.3
Average cost per ft. including casing	15/4	18/6	19/6	29/10	16/7
Percentage of successful boreholes...	77.5	52.9	75.0	33.3	69.4

*One of these boreholes was sunk for prospecting for reef and not for water supply.

New records have been set up this year as to footage drilled, rate of drilling and general lowering of costs, and great credit is due to the Boring Branch for so satisfactory a performance and in particular to the improvement effected in the Native Reserves, which is mainly responsible for this position.

The average cost per foot of all boreholes drilled this year is 4/7 per foot cheaper than in the previous year and is 3/- per foot cheaper than the previous record established in 1930.

The costs to private farming applicants shows a decrease of 2/8 per foot on the previous year's figures, but the most marked saving effected is in the Native Reserves, where the cost per foot has been lowered by 7/6 owing to the rapid drilling performed in the Gwanda, Nata and Shangani Reserves.

During the last eight years 32,457 feet have been bored for private applicants at an average cost of 17/6 per foot, including the cost of casing.

Water Supplies (*Native Reserves*).—In addition to the water boring operations and weir construction in the Native Reserves, windmills, tanks, and troughs have been installed at a number of the permanent supplies developed in the various reserves.

Owing to a reduction in the provision for this purpose only eight complete installations have been erected this year and four installations are in stock for erection next year.

Meteorology. — The Meteorologist and Hydrographic Engineer reports as follows on the work of that Branch:—

The change in the number of stations is shown below.

	31.12.31.	31.12.32.
Stations completely equipped	3	3
Barometric...	10	12
Thermometric	35	33
Rainfall	532	540
Total	580	588

The system of daily checking of reports has lead to an improvement in the accuracy of the observations.

Weather Forecasts and Reports.—The interchange of radio telegrams has extended the area covered by the weather map and will, it is hoped, reduce the time required for collecting the reports and improve the forecasts. Messages are exchanged with Tananarivo, Lourenco Marques and Broken Hill and Mpika at present and an exchange with Durban will be in operation shortly. Forecasting has been severely handicapped during the latter part of the year through the unsatisfactory arrangements made in the Union for the transmission of weather reports.

Aviation Meteorology.—The Imperial Airways service was opened in January. Considerable difficulty was experienced at first, principally owing to the lack of definite information

as to what was required of this office and also to the irregularity of the flights and the very short notice of changes of schedule which made it very difficult to obtain weather reports from widely scattered stations. The work at the reporting stations has been admirably carried out by the B.S.A. Police and Gaolers.

The work devolving on the Salisbury and Bulawayo offices has proved far more exacting and troublesome than was anticipated, and routine work has suffered. A rearrangement of duties and the introduction of mechanical assistance is contemplated.

Information Published.—Annual Report, Monthly Weather Report, Weekly Rainfall Summary, Daily Weather Report and forecast during the rainy season, daily records from five stations were forwarded monthly to London, summaries of rainfall are forwarded by cable to Poona and Rio de Janeiro. A climatology for Northern and Southern Rhodesia, Nyasaland and Mocambique was prepared in this office and forwarded to Dr. Geiger for publication.

Aneroid Levels.—Numerous enquiries were replied to under this head and the usual summaries of hourly pressure supplied to Geological Survey. Actual levels run to Miami, the Zambesi and Mount Nuza have proved that, under good conditions aneroid levelling is reasonably accurate.

Hydrography.—The routine work of this section comprises the collection of data relating to storm and winter flow conditions of the rivers of the country.

No new stations have been erected and the number remains at 13.

The Irrigation Staff have been of great assistance in making gaugings, but the increasing routine work has prevented any attempt at the reduction of autographic records.

Beit Trust Grant for Civil Aviation.—Through the instrumentality of the Director of Civil Aviation a sum of £1,000 has been put at the disposal of this office for Meteorological

Equipment and an extension of this grant is anticipated. This grant has enabled this office to proceed with the necessary equipment of stations in spite of the reduction in the annual vote which is barely sufficient at present for maintenance.

Water Ordinance.—The writer or the Hydrographic Engineer sat as Engineering Assessor on five Water Courts during the year, one of which was an Arbitration Court to deal with compensation claims of miner riparian owners below the Gwelo Municipal Dam on the Ngamo River. In all 44 applications were dealt with on which twelve were for mining purposes and 27 for approved irrigation schemes, the remainder being on miscellaneous matters.

Authority was sought for the irrigation of 1,906 acres and permits actually issued for the construction of schemes to irrigate 1,501 acres.

Further Notes on the Biology of the Red Locust.

By M. C. Mossop, M.Sc., Entomologist.

In the *Rhodesia Agricultural Journal* for October, 1933, the writer drew attention to certain colour changes that were observed to occur in the Red Locust, *Nomadacris septemfasciata*, Serv. In brief, it was stated that newly-moulted swarm adults are reddish brown with a median dorsal stripe and a pair of lateral whitish stripes, all of which extend on to the folded wings, the hind wings being colourless. After a certain amount of swarm activity the stripes practically disappear and the locusts take on a bright red to crimson appearance, the hind wing, including the axillary membrane, also becoming red or crimson. These colours were stated to persist until the yellow mating coloration appeared.

It was further stated that locusts kept in cages from about the time of their final moult fail to lose their prominent stripes, fail to turn red, and develop a purplish colour at the base of the hind wing, excluding the axillary membrane. Using Faure's theory of locustine production it was suggested that this difference in the development of coloration was brought about by the comparative inactivity of the caged specimens.

LOSS OF RED COLORATION.

Observations made during October indicate that comparative inactivity, or associated causes, can actually bring about the loss of the red or crimson colour of the body even in highly coloured specimens.

It has frequently been observed that after the passage of a swarm a widely dispersed and loose collection of loucts is left behind. These locusts appear to remain in long grass in the vleis, flying only when disturbed. Their behaviour suggests a collection of semi-gregarious, winged grasshoppers, and they have been known to remain in the same vicinity for a month

or more. Such specimens gradually lose the red body colour and also the red colour at the base of the front wing. The red changes to a pale brown, while the whitish stripes so prominent in newly-moulted locusts reappear. The red colour on the hind wing, including the axillary membrane, however, persists.

Notwithstanding the body coloration which suggests that the locusts are of the phase *solitaria* or an intermediate phase, it is evident that the specimens are of the phase *gregaria*. The presence of the pink on the axillary membrane, the pink (not purple) of the hind wing, and the comparative measurements of the fore wing and hind femur indicate *gregaria* specimens not long separated from a swarm. (At the breeding season the hind wing colour changes to purple.)

The foregoing observations were made in the field, but were confirmed by cage experiments. Representative red or crimson specimens were collected from passing swarms and placed in cages where their activity was reduced far below that normally obtaining in swarm life. Within a month most of them had assumed the pale brown and whitish coloration described above, with no noticable change in the hind wing. A few specimens collected at the end of September retained a pink body tinge at the end of October, but this had practically disappeared a fortnight later. In some specimens the pink of the hind wings took on a purplish tinge after an interval of a month to six weeks, and similar specimens have been collected in the field. The colour changes occurred in both sexes.

A question that immediately arose on first discovering these small, loose, apparently stationary congregations of pale brown locusts was, "What becomes of them?" The problem was partly solves a few days later when some swarms of typically red locusts were found to have a sprinkling of pale brown ones among them, the assumption being that the loose congregations had joined a passing swarm. But it is improbable that all such loose congregations will eventually join a passing swarm. It is quite likely that those left behind may produce in the next generation small local outbreaks of the phase *gregaria*, while some may give rise to individuals of

the phase *solitaria* or a sub-division of the intermediate phase that has been suggested, namely, *transiens dissocians*.

A practical outcome of the presence of striped, pale brown locusts of this species, either in their loose congregations or mixed with a normal swarm, is that the lay observer may assume that, as a change of colour is occurring, egg-laying is imminent. Indeed, as was anticipated, this has actually occurred in reports. It should be noted that as mating and egg-laying time approaches, the colour assumed is a distinct yellow, not pale brown, and that the change occurs more especially in males.

FURTHER OBSERVATIONS ON DEVELOPMENT IN CAGES.

Further observations on Red Locusts of the swarm phase which had been kept in cages since the time of their final moult in April have revealed that a change of body colour, apparently coincident with sexual maturity, occurs in early November. The base of the hind wing at this time was a deep purple and the axillary membrane was still clear. Specimens kept in large cages with a double roof, in which sun could penetrate only through the gauze sides, turned a dark Cologne earth body colour, the stripes being pale brown to sepia. The dorsal stripe tended to persist, while the lateral stripes tended to disappear. The change was more noticeable in the females, the males mostly attaining a yellowish greeny brown colour with the stripes still present.

Eggs were laid in early November by these locusts. Sexual development may have been encouraged by the moisture in the grass, of which a fair quantity was supplied daily, uneaten grass accumulating on the floor of the cage. The locusts would frequently be found hiding in this grass with the result that their micro-climate would be considerably more moist than that in which normal swarm locusts exist.

Locusts separated from a swarm, or solitary locusts of this species, would theoretically be liable to earlier sexual development than those in the swarm. They would not suffer from the loss of moisture that must occur in flying, active swarms, and their habit of remaining inactive and hidden in the grass would provide them with a moister micro-climate which would tend to accelerate sexual development. These moist environ-

mental conditions obtain in the experimental cage described. Similar conditions were probably experienced by the parents of the two specimens from Melsetter discussed in a previous paper (loc. sit.). It was suggested that these two specimens were probably the progeny of early sexually matured parents of the phase *solitaria*. The early maturity of caged specimens living in a moist micro-climate tends to confirm this suggestion, not only on the basis of the moister micro-climate enjoyed by a solitary-living Red Locust, but also on the basis of the greater pre-seasonal precipitation that occurs in parts of the Eastern Border.

Specimens kept in a cage to which the sun had access developed on similar lines to those kept in the covered cage, but more slowly. One female, however, became almost entirely black and lost its lateral stripes. Mating took place from early November, but by the middle of the month no eggs had been laid. The loss of moisture in this cage would be obviously greater than in the covered cage, with the result that a state of maturity intermediate between the specimens in the covered cage and those in the field was attained.* It should be mentioned that the ovaries of field specimens, measured *in situ* above the alimentary canal, were only 12 to 15 mm. by 2 to 3 mm. in early November.

In some recent preliminary experiments, Urarov† has demonstrated that the Red Locust, given suitable conditions of temperature and moisture, can oviposit within a few weeks of the final moult. It would seem reasonable to suggest, on the assumption that moisture is a factor accelerating sexual development, that individuals of the phase *solitaria*, because of their moister environment, normally mature sexually in a shorter time than individuals of *gregaria* in a swarm.

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*At the end of November, after the submission of this article for publication, numerous Cologne earth to black specimens were received from the field. In these the dorsal stripe was pale brown to pale yellow and the abdomen, especially in males, yellow. Lateral stripes were very indistinct. No serious explanation is offered, unless it is that the colour is a manifestation of breeding coloration in specimens that have not participated in the long migration that precedes the breeding season. No black specimens were observed when the Red Locust first invaded the Colony last year.

†Uvarov, B.P. Preliminary Experiments on the Annual Cycle of the Red Locust (*Nomadacris septemfasciata*, Serv.). Bull Ent. Res. XXIV. 3, pp. 419-420. London, Sept., 1933.

Southern Rhodesia Veterinary Report

SEPTEMBER, 1933.

AFRICAN COAST FEVER.

There have been no cases at any of the infected centres.

TRYPANOSOMIASIS.

Two cases occurred in the Melsetter district.

MALLEIN TEST.

Forty-two horses, 6 mules and 33 donkeys were tested on importation with negative results.

EXPORTATIONS.

To the United Kingdom *via* Union ports in cold storage: Fore quarters, 5,285; hind quarters, 5,377; boned quarters, 2,760; livers, 21,589 lbs.; tongues, 10,966 lbs.; hearts, 9,285 lbs.; skirts, 3,579 lbs.; shanks, 4,981 lbs.; tails, 4,397 lbs.; kidneys, 289 lbs.

G. C. HOOPER SHARPE,
Acting Chief Veterinary Surgeon.

Southern Rhodesia Weather Bureau.

OCTOBER, 1933.

Pressure.—Mean barometic pressure was generally slightly above normal.

Temperature.—Mean maximum temperatures were generally above normal in the south and below normal in the north. Mean minimum temperatures were generally slightly below normal.

Rainfall.—The rainfall for the month was well below normal, amounting to only a quarter of an inch for the month. The falls occurred on nine days fairly well distributed throughout the month. The 17th was the only day when rain was fairly general.

OCTOBER, 1933.

Station.	Pressure Millibars, 8.30 a.m. Mean.	Pressure Normal.	Temperature in Stevenson Screen °F. Absolute Max.	Absolute Min.	Mean Max.	Mean Min.	Mean ½ Max. Min.	Mean Normal.	Mean Dry Bulb.	Mean Wet Bulb.	Rel. Hum. %	Dew Point F.	Cloud Amt. 0-10	Precipitation Ins.	Precipitation Normal	Precipitation No. of Days	Altitude (Feet)
Angus Ranch... ...	...	...	103	52	90.5	63.9	77.2	76.9	76.0	63.8	56	56	...	.42	0.9	2	...
Bindura...	891.9	...	94	48	87.5	62.5	75.0	...	73.5	59.2	42	49	0.9	.04	0.7	1	3,709
Bulawayo	869.2	869.1	94	48	87.5	58.5	73.0	72.3	73.2	58.2	39	45	1.4	.07	0.9	2	4,425
Enkeldoorn	858.3	...	92	44	85.4	56.2	70.8	71.3	72.4	57.8	40	46	0.9	.02	1.3	1	4,787
Fort Victoria	895.9	895.5	98	45	86.6	58.2	72.4	71.1	73.5	59.3	42	48	...	.09	1.1	2	3,570
Gatooma	...	...	98	47	92.1	58.4	75.2	76.2	74.1	59.5	41	48	1.1	.34	1.1	2	3,870
Gwanda	906.1	...	99	47	89.4	60.9	75.2	...	74.2	60.2	43	50	...	Nil	0.9	...	3,228
Gwelo	863.3	...	93	46	87.0	56.6	71.8	72.5	72.2	57.6	40	46	0.9	Nil	0.7	...	4,627
Inyanga	837.1	...	84	44	78.1	54.2	66.1	...	71.1	55.3	33	40	...	3.56	1.2	4	5,513
Manchester...	...	...	84	45	75.0	57.2	66.1	..	62.9	55.8	64	51	...	.79	...	2	...
Miami	879.0	...	95	48	87.0	60.2	73.6	...	74.4	60.0	41	49	0.5	.84	0.2	1	4,077
Mount Nuza	802.6	...	78	40	68.4	50.6	59.5	...	60.0	51.0	53	42	3.1	.59	...	4	6,666
Mtoko	877.8	...	93	50	85.2	61.0	73.1	...	73.7	59.4	41	48	0.9	.15	0.8	1	4,140
New Year's Gift...	...	...	101	47	89.4	58.8	74.1	...	73.7	61.7	50	54	...	.35	1.2	2	2,690
Nuanetsi	962.3	...	105	45	91.5	60.7	76.1	..	75.9	64.0	51	56	3.8	.18	0.9	4	1,650
Riverbank...	...	...	101	48	93.8	60.4	77.1	76.0	75.4	59.4	37	47	...	.01	0.7	1	4,090
Rusape...	862.6	...	90	41	82.9	53.5	68.2	...	71.1	56.1	37	43	1.1	.83	...	3	4,630
Salisbury	855.4	855.7	91	46	84.7	56.9	70.8	71.0	72.0	57.0	39	44	1.5	.35	1.3	4	4,885
Shabani	907.7	...	100	51	88.5	62.3	75.4	...	74.4	60.5	43	51	2.6	.03	0.7	1	3,192
Sinoia	888.1	...	95	45	90.3	57.1	73.7	...	77.0	59.9	35	47	0.6	.64	1.2	2	3,793
Umtali...	893.9	894.4	95	47	81.0	57.9	71.5	70.9	72.2	60.6	51	53	2.7	.32	1.2	2	3,670
Wankie	925.7	...	103	60	98.2	71.6	84.9	...	83.0	61.7	27	46	0.4	Nil	0.3	...	2,566

Rainfall in October, 1933, in Hundredths of an Inch. Telegraphic Reports.

Area	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Tot[illegible]
1	.01	...	...	...	...	...	...	...	...	...	...	...	.01	...	...	.01	.03	...	...	...	...	...	...	...	...	...	...	...	...	...	.01	.0[illegible]
2	...	...	...	...	...	...	...	...	...	...	...	...	.02	...	...	...	.13	...	...	...	...	...	...	...	...	...	...	...	...	...	.01	.1[illegible]
3	...	...	...	...	..	...	...	...	...	...	...	...	.10	.02	...	...	.44	.05	...	...	...	...	...	...	...	.02	...	...	...	...	...	.6[illegible]
4	.01	...	...	...	.01	...	...	...	...	...	...	...	.01	...	...	...	.06	.01	...	...	...	...	...	...	...	.07	...	...	...	...	...	.1[illegible]
5	...	...	..	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	.02	...	.0[illegible]
6	.03	...	...	.23	.25	...	...	...	...	...	...	...	...	...	...	...	.01	...	...	...	..	...	...	...	...	...	...	...	...	...	.05	.5[illegible]
7	.30	...	...	.01	.02	...	...	...	...	...	...	...	.02	...	.12	...	.29	.02	...	...	...	...	...	...	...	...	...	...	..	...	.03	.8[illegible]
8	.07	...	...	.08	.02	...	...	...	...	...	...	...	...	...	...	...	.04	...	...	...	...	...	...	...	...	...	...	...	...	...	.11	.3[illegible]
9	.12	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	.03	.21	...	...	...	...	...	...	...	...	...	...	...	...	...	.3[illegible]
10	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	.07	...	...	...	...	...	...	...	...	...	...	...	...	...	...	.0[illegible]
Mean	.06	—	—	.02	.02	—	—	—	—	—	—	—	.01	—	.01	—	.08	.03	—	—	—	—	—	—	—	.01	—	—	—	—	.01	.2[illegible]

Locust Invasion, 1933.

SOUTHERN RHODESIA.

Monthly Report No. 11. October, 1933.

No record has been secured in the Colony during the month of any species of swarm locust other than the Red Locust (*Nomadacris septemfasciata*).

Swarms of this species have been in evidence practically throughout the Colony, their flights being irregular and not of a definitely migrationary character.

Much damage has been done to young grass and many stock-owners have found it desirable to avoid burning their pastures in view of the prevalence of locusts, which attack the new growth with such avidity that only bare ground remains after a heavy visitation. This has been particularly observed near the Eastern Border, where locusts are more or less continuously present.

Irrigated crops have been destroyed in certain instances, but no general destruction of such crops is reported.

At the end of the month development of the ovaries had only proceeded to a slight extent and there was not yet any indication of appearance of a yellow colour in the ovaries. The male testes were, however, well developed and of a pronounced yellow colour. The typical yellowish breeding coloration of the locusts themselves was still altogether lacking.

In the latter connection it may be stated that certain individuals of both sexes left behind by passing swarms apparently lose their red body coloration and tend to become

light brown with pale stripes, the pink suffusion, however, persisting at the base of the hind wings. Such specimens have been mistaken for breeding individuals and led to incorrect reports.

The public should realise that the real breeding colorations is decidedly yellowish, and in the case of the males frequently a vivid lemon yellow.

With respect to the Tropical Mitgratory Locust (*Locusta m. migratorioides*) there appears a possibility of eggs having been laid in certain places after these locusts became sexually mature in May this year. In this case hatchings of hoppers might occur shortly after the first rains. No such deposits are, however, known and extensive hatchings of this nature are not anticipated.

RUPERT W. JACK,
Chief Entomologist.

Farming Calendar.

DECEMBER.

BEE-KEEPING.

With a normal season the first or main honey-flow of the year should now be over and the honey ready to be robbed. Before doing this, see that all or the main portion of the frames are capped and sealed, otherwise there will be trouble later on by fermentation. There is nothing on the market to equal the Porter bee-escape board to clear out the bees from the crate, but be sure and see that the board in question is placed the right side up under the crate; failure to do this (and in the hurry of the minute it can easily be so done) will result in the probable suffocation of the bees and the loss of the honey, to say nothing of the chances of robbing from any close-by hives. Replace the empty combs and frames as soon as possible on the hives, to be cleaned up and mended where necessary, and for future storage of more honey. During the very hot spells watch the hives and provide extra ventilation, by inserting small metal wedges between the crates, just wide enough to allow air in, but not a bee under any consideration. Keep all water tins under the hive-stand legs full of water, and see that water is available for the worker bee, which drinks a good deal. When extracting honey, do so in a bee-tight room or verandah, otherwise the operator may have a lot of trouble from other colonies, which quickly find where honey is. Always have one or more crates of shallow frames ready with foundation fixed to place on hives as the season may warrant; such will mean always something for the bees to work at, and during the last flow they may be invaluable to store any such catch crop of nectar, as from tobacco, etc., when the natural flora is finished.

CITRUS FRUITS.

This is a good month to plant citrus trees in their permanent positions. They should on no account be planted deeper than they stood in the nursery. Water each tree immediately after planting it to settle the soil, then loosen the surface when sufficiently dry to check weed growth and restrict evaporation; continue loosening the surface soil after each rain or watering. If good rains have fallen, disc the grove in two directions, then sow the cover crop and harrow also in two directions. If the grove is weedy it should receive a shallow ploughing in place of the discing. Then sow the seed and harrow the soil. All bearing trees must be kept well watered if the weather continues to remain dry. Trees that suffer for want of moisture while the young fruit crop is developing will be adversely affected, and the crop—if any—will be of inferior quality. Continue to rub off all water shoots or suckers which develop on the tree stems.

CROPS.

Keep the cultivators going, both on planted and unplanted lands, whenever weather conditions are favourable. Destroy the weeds while young and before they obtain a firm root-hold.

Continue planting maize, cotton, beans and ground-nuts as early as possible this month, followed by sunflowers, Sudan grass, manna, pumpkins and cattle melons. Linseed, cowpeas, teff grass, oats, Sunn hemp should be planted after the other crops are in. Ensilage crops may be sown at the end of the month. When harrowing maize after planting, this work

should be done in the heat of the day when the young plants are flaccid and not easily broken. On lands not yet planted the crop of weeds should be kept down by disc-harrowing. It is a good plan to harrow or disc-harrow immediately before the planter, or alternatively to follow the planter with a light harrow. Treat seed oats for smut before sowing. Use one pint of formalin to 25 gallons of water and steep the bag of seed for ten minutes. Earth up early planted potatoes. Keep a look out for the stalk-borer, and top or otherwise treat affected plants. New lands and old pastures may be broken. as circumstances permit, during December, January and early February, and again ploughed in from May to July. If they carry a heavy crop of grass it should be cut or burnt to enable good, clean ploughing to be done. Sweet potato slips should be planted early in this month. Do not fail to have in a few acres of this valuable crop.

DECIDUOUS FRUITS.

Cover crops may be planted when the rains commence, as recommended under citrus fruits. Summer pruning may be commenced this month. If all undesirable shoots are taken out of the trees, the remaining shoots will receive sufficient air and light to mature. Ripening fruit must be carefully harvested, graded and packed if satisfactory prices are to be secured. Do not gather any fruit when it is wet. Keep all recently planted trees in good condition; the first year's growth is the most important. If the undesired shoots are rubbed off when they first appear, the retained shoots will receive all the nourishment and the tree will then grow to a large size.

ENTOMOLOGICAL.

Maize.—The first half of this month appears to be the best period during which to plant maize for the avoidance of stalk-borer attack—at least in the Salisbury district. Hoe out and remove volunteer maize plants before the new crop is up, as they are liable to be infested with borer, which tends to spread to surrounding plants. Red soils may be baited with chopped Napier fodder or other suitable green stuff dipped in arsenate of soda 1 lb., cheapest sugar 8 lbs. or molasses 1 gallon, water 10 gallons, to destroy surface beetles, snout beetles and other insects which may affect the primary stand.

Tobacco.—The enemies of this crop are in general most active during December, whilst the crop is still in the early stages of growth.

For information regarding tobacco pests, see "Rhodesia Agricultural Journal," January, 1928, or Bulletin No. 665.

In general, poisoned baits may be used against surface beetles, grass-hoppers, crickets and cutworms. Against surface beetles, arsenite of soda 1 lb. in 30 gallons of water used to moisten maize bran is a good bait. Against grasshoppers and crickets the addition of 8 lbs. sugar or 1 gallon molasses to each 1 lb. of arsenite of soda is recommended. Spray with arsenate of lead (powder) 1 lb. in 30 gallons of water against leaf-eating insects and as a protection against leaf miners and stem borers. Transplants may be dipped head downwards as far as the roots in the poison. Discard seedlings infested with stem borer and root gallworm.

Cutworms.—Keep ground around seed beds as free as possible from vegetation, to prevent female moths from laying eggs there. From the time the plants show foliage of the size of a sixpence they should be sprayed weekly with arsenate of lead (powder) 1 lb. to 30 gallons of water. This should prevent cutworms developing in the beds, as the young cutworms attack the leaves of the seedlings, and so ingest the poison.

House Flies.—With the coming of hot weather and the rains, house flies greatly increase, and should be kept out of dwelling houses by

mosquito netting, or poisoned in the following way:—Dissolve 1 lb. of sodium arsenite in 10 gallons of water, and add about 10 lbs. of cheap sugar (2 gallons of treacle) or other sweet substance. The mixture should be sprayed upon branches of shrubs or trees, which may be hung up in convenient places where flies congregate. These insects are attracted to the bait, and are easily poisoned.

Mosquitoes, Stable Flies.—Destroy breeding places around homestead. Poison or trap adults.

Potatoes.—Ladybirds and caterpillars may be injurious to the foliage, and on sandy soils blue blister beetles sometimes cause damage. Spray with arsenate of lead (powder) 1 lb. to 25 gallons of water.

Kitchen Garden.—Marrows, etc., are commonly attacked by leaf-eating beetles. Spray with arsenate of lead (powder- 1 lb. in 25 gallons water, plus 8 lbs. cheapest sugar or 1 gallon molasses. Dusting lightly with pure arsenate of lead powder should give protection. Young plants of the cabbage family may be dusted with pure arsenate of lead powder or with such powder mixed with up to six or eight parts of finely sifted, thoroughly slaked lime as a protection against leaf-eating insects.

Fruit Trees.—The regular collection and destruction of fruit beetles may be necessary. Choice varieties of peaches, etc., may be netted as a protection against pests.

FLOWER GARDEN.

This month is generally showery, and constant stirring of the soil is, therefore, necessary to keep it loose. Seeds of perennials and annuals for February blooms may be sown. Transplanting should be done in the evening or on a cloudy day. Carnations should be kept free from dead wood, and climbers attended to.

VEGETABLE GARDEN.

All vegetable seeds may be planted. All advanced plants should be constantly cultivated. Potatoes should be ridged, and peas, beans and tomatoes staked. This is a good month for planting the main crop of potatoes.

FORESTRY.

Final preparations for planting should be made, including harrowing or pitting. Early plantings may be carried out if the season is a good one. Planting should be carried out on dull, rainy days, or failing such days, late in the afternoons. Great care should be exercised in planting out to avoid bending the tap root, and to set the trees in the ground at the same level as they were in the seed bed or tray. Late sowings of Cedrela toona seed may be made.

POULTRY.

The poultry keeper should take precautions whereby the wet weather will not affect his birds' health and their laying powers. All houses must be absolutely watertight, the floor raised well above the level of the surrounding ground, thus preventing water seeping in and making it damp. The birds themselves should not get wet, and no pools of water should be seen in the runs. Foodstuffs also must be kept absolutely dry.

Many birds will at present be moulting; these require special treatment to bring them through it quickly, and if possible keep them in lay during the period. A pamphlet on this can be obtained from the Poultry Officer,

Department of Agriculture. This lack of attention to the birds during the moult is one of the causes of the scarcity of eggs at this season. There is no need for it if poultry keepers would only look after their birds properly.

Those who intend disposing of their turkeys for killing at Christmas must avoid cooping them up, as is done when fattening fowls, for they immediately mope and go off their food. Give them free range, and in addition to their usual evening feed of maize, during the first week of December give one of wheat or maize in the morning. and during the second and third weeks three meals a day, each one containing, in addition to wheat or maize, some crushed monkey nuts or sunflower seeds. Plenty of thick milk and chopped-up onions or onion tops should also be given.

Those who go in for ducks should feed well and get as many to marketable size as possible by Christmas, when they usually fetch good prices. They should be kept in a small run; nearly all their food should be wet mash, bran, pollard, maize meal, meat meal and milk, as much as they will eat three times a day, i.e., they should practically be allowed to spend their existence eating and sleeping. Big duck breeders often give a fourth meal by lamplight at 10 pm., and the first meal is given at sunrise.

STOCK.

Cattle.—Feeding should be continued on the same lines as in November. Keep a close eye on any store bullocks that have been selected for fattening on grass.

Ranching cattle should not require any attention beyond dipping. Every effort should be made to have all the female stock in good condition for the breeding season.

Milch cows should be protected as much as possible from cold rains and hot sun. Yarding at night in a clean kraal provided with a simple lean-to shed well bedded up will be found to be very beneficial in seasons of protracted rainfall. The calf-pen should be kept clean, dry and sweet, and young calves will be better kept in during very hot or very wet weather.

Sheep.—Graze on the higher lands, keeping the kraals clean, dry and airy, and watch for ticks. Take out the rams at the end of the month.

DAIRYING.

During the months of December and January veld grazing is usually plentiful, and very little extra feed in the form of concentrates is required for dairy stock. It should be borne in mind, however, that heavy milking cows are unable to satisfy their requirements for milk production from veld grazing alone, and should receive a daily allowance of grain; the latter should be fed at the rate of 2 lbs. for every gallon of milk produced daily, i.e., a cow producing three gallons of milk should receive 6 to 7 lbs. of concentrates. An excellent mixture for this purpose is one consisting of four parts maize meal and one part ground-nut cake.

During wet weather, the provision of a clean dry shelter for calves is essential; the latter should not be crowded together in a small, damp, badly ventilated pen or muddy kraal. When treated in this manner, a calf is very liable to contract various ailments such as scour, etc. Scour is entirely preventable, and is usually caused by over feeding, or feeding from dirty pails, feed boxes, etc. Calves which contract scour should be isolated, the milk ration reduced, and they should be dosed with a few tablespoonfuls of castor oil.

Under the weather conditions which now obtain, cream should be despatched to the creamery at least three times a week. It is of the greatest importance that cream should be cooled immediately after separation, and should be kept cool while on the farm and whilst in transit to the railway station or siding. While the cream is being cooled, it should be frequently stirred, using a stirrer with a plunger attachment. Warm, freshly separated cream should not be mixed with old cream which has already been cooled. Cool the fresh cream first and then mix thoroughly with the old cream. Gassiness is a common defect in the cream received at the creameries at this time of the year, and is caused by gas-producing organisms with which the milk and cream are contaminated. These organisms abound in mud, manure, etc., and develop and multiply very rapidly at high temperatures. Any precautions therefore which may be taken to eliminate dirt, manure, etc., from the milk and to keep the cream cool will prevent the development of gassiness.

As the night temperatures are fairly high, cheese-makers should not attempt to use night's milk for cheese-making; morning's milk plus a starter will give the best results. Gouda cheese-making operations are not usually successful at this season of the year, owing to the poor quality of the milk and the prevalence of gassiness. This type of cheese is best manufactured during March and subsequent months.

TOBACCO.

Continue preparation of land. The best results are obtained by transplanting on well prepared soil. Transplanting should be pushed on with as fast as transplants and climatic conditions will allow. As soon as plants begin to grow, go over the field and fill in all missing hills with strong selected plants, and then apply fertiliser to hasten growth and ensure early maturity. Cultivation should be commenced as soon as the plants start growing, especially on sandy soils. The crust caused by heavy rains should be pulverised through cultivation as soon as the surface soil is dry enough for tillage; this gives the young plants the benefit of the moisture stored in the soil. Do not neglect the late sown seed beds. Make every effort to finish transplanting before the end of the month, so that the crop will be harvested before dry, cool weather begins.

VETERINARY.

Occasional cases of horse-sickness may occur during this month. With the great increase in ticks, due to the heat and moisture, cases of redwater and gall-sickness may be expected, more especially amongst Colonial stock imported since the last rainy season. The cool weather which frequently follows the early rains is an excellent time for castrating calves and other animals.

WEATHER.

In Mashonaland the rainfall during this month varies from eight inches along the eastern border to six inches in the west. In Matabeleland it varies from five-and-a-half inches in the west to four-and-a-half inches in the south. Considerable divergencies from these normals may occur in individual seasons, but on the whole this month is the most regular in its behaviour. Very heavy downpours may be looked for, and it is well to be provided by drains and ditches against the effects of very heavy rain storms. A dry spell about Christmas time is a very frequent, though not invariable, event in Rhodesia. This partial drought may last only a fortnight, or may extend to six weeks, in the latter event often causing some anxiety regarding young crops, especially those not yet through the ground. The best means of meeting this condition of the weather is by frequent surface cultivation by harrow or horse hoe to preserve a loose soil mulch on the surface and prevent losses of soil moisture by evaporation.

JANUARY.

BEE-KEEPING.

This month is a slack one for actual hive work. Each hive should continue to be carefully watched to see that any attempt by the wax moth to gain a footing is at once stopped. In the great heat of this month, see that proper ventilation is supplied, as well as enough water. Precautions against the depredations of white and other ants should also be watched daily. Where possible. examine now and again the brood chamber for queen cells, and destroy them if not wanted. Requeening can be done where desired on the uniting system, if the apiarist does not know of the better plan of rearing his own queens. In the workshop have a spare hive or two complete and ready for occupation, well painted, for any new swarms that may be required in the coming months. Though the second honey flow of the season is not due to start until about March or April, there should be ample stores coming in meanwhile to keep all bees busy in breeding, nursing, and bringing the hive generally to full strength for the winter, as well as for their own daily food supplies. There will not be enough honey coming in now for surplus purposes, therefore see that the supers are not left on the hives to a greater degree than to give the inmates plenty of room to loaf in.

CITRUS FRUITS.

The planting of citrus trees should be completed if possible by the end of the month, for trees planted later may not harden up before the winter; they then become susceptible to winter injury from cold. This month is the best one for planting shelter belts to protect all varieties of fruit trees from the prevailing dry winds. Cover or green crops may be planted during this month; if the grove has been over-run with grass or weeds, sow the cover crop seed more thickly. This will assist in smothering future weed growth. Continue suppressing any undesirable shoots that may develop on the tree trunk or other parts of the tree. Drain any depressions that allow rain or irrigation water to accumulate at the base of the trees, for trees permitted to stand in water will speedily fall victims to disease or pest injury.

DECIDUOUS FRUITS.

Continue planting cover or green crops between the trees. These crops may then be turned under towards the end of the rainy season to furnish the necessary humus.

Summer pruning may be continued. Rub or break off any undesirable shoots that have a tendency to crowd each other; suppress all growths on the main stem from the ground level up to the main arms of the tree, for these are unnecessary. If next year's fruit crop is to be of good size and quality, the inner fruiting wood of a tree must receive sufficient air and light to mature fully. If the new growth is too dense it will prevent the fruiting wood from maturing, and poor crops will be the result. The thinning out of the summer growth will overcome this crowding and weakening of the fruiting wood.

Many fruits will be ripening during the month. Do not permit the fruit to become over-ripe on the trees; rather harvest it at the correct stage and store or sell the surplus.

Plant shelter trees if the orchard is exposed to the prevailing winds, as good crops of fruit cannot be expected from inadequately protected fruit trees.

CROPS.

If not already sown, put in the ensilage and fodder crops at once. such as maize and legumes, oats and other hay grass crops. Sow short season crops like haricot beans, linseed, buckwheat, peas, summer oats, gram and mung bean. Plant out grasses and kudzu vine for pasture. Ridge potatoes and cultivate thoroughly. Main crop can still be planted. Quick growing green manuring crops, such as cowpeas, soya beans and sunn hemp, may still be sown this month. Earth up ground nuts so that a small amount of loose soil is thrown over the crowns of the plants. This assists the formation of nuts. If not already done and where practised, legumes or long season oats such as Algerian can be sown under the maize crop for grazing and to add nitrogen and humus to the soil. Cultivate all growing crops well, and thoroughly eradicate weeds. Overhaul all hay-making implements and ploughs and get in thorough repair in preparation for the haying and ploughing seasons. Endeavour to mow grass fields early for hay and litter, and to obtain second cutting for hay in April. Fallowed lands or fields not yet planted may be disc-harrowed or ploughed to prevent weeds from seeding. Mow grass paddocks infested with annual weeds to prevent the weeds seeding. Prevent Mexican marigold and other noxious weeds seeding by hoeing or pulling out the plants by hand. Keep a sharp look-out for maize stalk borer. Cut off the tops of infested plants or treat them with a recognised chemical preparation. If topping is practised, remove tops from land, and bury, burn or feed them at once to farm stock. Watch the maize lands for witch weed. Prevent witch weed plants from seeding by cultivation and by hand-pulling the plants. Make as much manure as possible by placing grass and litter in cattle kraals, pig sties and stables. If there is stumping and clearing to be done, push on with it. Endeavour to get as much of the new virgin land as possible broken up during this and the two following months.

ENTOMOLOGICAL.

Maize.—Late planted maize, particularly crops planted after the New Year are frequently attacked by the maize stalk borer (*B. fusca*, Full.) in districts where this pest is prevalent. The yield of grain from heavily attacked stands is usually very low, and such crops are most economically used as ensilage. Plants attacked are easily detected in the fields, as the newly hatched caterpillars eat the young leaves before entering the stalk. Top dressing with a suitable insecticide should be employed to ensure a good yield. There are several insecticides which can be used for top dressing which kill the young caterpillars without causing severe injury to the plant. Kerol, Kymac or Hycol use at a dilution of 1 in 300, or Pulvex, 1 in 54 gallons of water, give satisfactory results. A new preparation, Derrisol, is highly recommended by the manufacturers at 1 in 1,000, and is stated to be quite innocuous to the plants. The liquid should be poured into the funnel-shaped cup formed by the young leaves. Only those plants showing attack are usually treated. With a light infestation, one native can treat about five acres per day. Several treatments may be necessary. Young maize plants up to six weeks old can be treated by cutting the plant below the point attacked. The portions cut off must be removed from the lands.

Various leaf-eating insects (including the snout beetle (*Tanimycus destructor*), the surface beetles, grasshoppers, etc.) attack young late-planted maize.

The attack by the snout beetle may be very severe. If there is time, it is often advisable to harrow in the old crop, treat the land with poison bait and re-plant, or poison bait may be used without removing the crop. The best carrier for poison bait is chopped Napier fodder or some other green succulent grass, including maize itself; failing this, maize or wheat bran may be used. The carrier is thoroughly covered or impregnated with a solution of arsenite of soda 1 lb., molasses 1½ gallons, or cheapest sugar 8 lbs., water 10 gallons, and broadcast. The cheapest arsenite of soda to

employ is locust poison, diluted 1 in 200, and equivalent quantity of sweetening agent added. The best results are obtained if the broadcasting is done in the evening, as the hot sun dries up the bait too quickly and renders it unattractive to the beetles.

Army Warm (*Laphygma exempta*) may put in an appearance during the latter half of December, and a sharp look-out should be kept for the caterpillars, especially on sweet grasses near the maize lands and on "rapoko grass" (*Eleusine indica*) on the lands. (See *Rhodesia Agricultural Journal*, October, 1930, page 1055.)

Black Maize Beetle.—Both larvæ and adults of this beetle are active during this month. Hand collecting of the adults is the only practical procedure. For further control measures, see *Rhodesia Agricultural Journal*, August, 1933.

Potatoes.—This crop, if attacked by leaf-eating ladybirds, blister beetles or other leaf-eating insects, may be sprayed with arsenate of lead (powder), at the rate of 1 lb. in 25 gallons of water. This poison may be combined with Bordeaux Mixture when spraying against early blight. To protect potatoes from potato tuber moth, the rows should be ridged deeply and the tubers kept covered with soil.

Tobacco.—Tobacco in the field is attacked by many insects during this month, and growers should keep a copy of Bulletin No. 665, "Tobacco Pests of Rhodesia," handy for reference, or refer to *Rhodesia Agricultural Journal* for January, 1928. The following very brief account of the more common insect pests attacking this crop may help the grower who cannot consult the above-mentioned bulletin.

Cutworms.—Keep all lands free from weeds up to the time of planting out.

Stem Borer.—All seedlings showing the characteristic swelling should be destroyed by fire. Plants in the field should be destroyed and replaced, or the plant may be cut off below the swelling and one sucker encouraged to grow. The latter procedure needs to be carried out early.

Leaf Miner.—All primings should be destroyed, and infected leaves may be picked off.

Seed Beds.—Seed beds which are no longer required should be cleaned up and not allowed to become a breeding ground to infest the fields. Beds in use should be kept properly covered with limbo and sprayed weekly with arsenate of lead 1 lb. in 30 gallons of water.

Wire Worms (*Trachynotus* spp.).—Several species of wire worms attack this crop during January, particularly on sandy soils. It is now too late to attempt control. Control depends upon the accurate timing of the emergence of the adult beetle and poisoning wih a poison bait. Emergence usually takes place late in April or in early May. The bait consists of maize meal or bran poisoned with arsenite of soda (locust poison, 1-200). The bait is made up into balls, scattered about the lands. The balls should be covered with leaves, to give attractive shade and to assist in keeping the bait moist. Moisture should be added when necessary.

Surface Beetles (*Zophoses* spp., *Gonocephalum* sp.)—The same control measures apply as for wire worm. Baits recommended against wire worm can be applied during January. No sweetening matter is necessary.

Bud Worm (*Heliothis obsoleta*).—Destroy all caterpillars by hand during "topping." Examine all bagged seed heads weekly and destroy any caterpillars discovered.

Other Leaf-Eating Caterpillars.—A bad attack in the field may be controlled by spraying with arsenate of lead (powder), 1 lb. to 30 gallons of water. A knapsack spray pump with a cyclone nozzle is necessary. Hand picking may be employed.

Beans, Cowpeas, etc.—Haricot beans and cowpeas are liable to attack by the stem maggot (*Agromyza* sp.). This small fly deposits its eggs in

the young leaves, often within a few days of germination. The larvæ mine along the veins and down the stem, pupating about soil level. Practically nothing can be done to protect a field crop. Velvet beans, Jack beans and dolichos beans are not attacked by this pest.

All varieties of beans are attacked by a leaf-eating beetle (*Ootheca mutablis*). This small insect can be controlled by spraying with arsenate of lead (powder), 1 oz. to 3 gallons of water.

Blister beetles are often very numerous on the flowers of all species of beans and cowpeas. Hand collecting has been found to be the most economical measure.

The bean stem weevil is a minor pest of beans in the kitchen garden. All plants attacked by this weevil should be picked out and burnt.

Sweet Potatoes.—Sweet potatoes may be attacked by caterpillars of the sweet potato sphinx moth. These should be collected by hand.

Kitchen Garden.—Marrow and cucumber plants about to set fruit may be sprinkled regularly with the following formula to destroy fruit flies which "sting" fruit:—Arsenate of lead (powder), 1½ ozs.; molasses, ½ gallon, or cheapest sugar, 2½ lbs.; water. 4 gallons. To destroy leaf-eating insects generally, dust plants with arsenate of lead (powder), 1 part in 20 parts of finely-ground maize meal or finely-sifted slaked lime. *Aphides* (plant lice) may be treated with soap, 1 lb. in 5 gallons of water, or tobacco wash, or simply by regular spraying with a forceful stream of cold water from a spray pump.

Fruit Trees.—Deciduous fruits are subject to attack by large beetles, which should be destroyed by jarring into a net and dropping thence into a tin containing water, with a film of paraffin on the surface. Trees should be covered in mosquito netting to protect the fruit from fruit-piercing moths. The large adult beetles of the fig borer may be seen on the young shoots and should be destroyed. Borers in the trunks of the trees may be killed by injecting a little carbon bisulphide.

Mosquito, House Flies, etc.—Screen windows and doors. Destroy breeding places around homestead. House flies may be poisoned cheaply with sweetened arsenite of soda solution. Write for directions.

When in doubt as to the identity of any pest or the method of dealing with it, apply promptly to the Chief Entomologist, Salisbury, bringing or sending specimens of the insects concerned. Note, however, that it is sometimes feasible to prevent injury from pests for which no practical remedy is known. Farmers should therefore endeavour to obtain some knowledge of the pests of the crops they are growing through the articles published in this Journal.

FLOWER GARDEN.

This month requires all one's energy in the flower garden. Annuals may still be sown for late flowering before the season is over. Planting out should be done as early as the weather permits, and advantage taken of a dull day after a shower for this work. If care be exercised much smaller plants may be put out than would at first be thought advisable, as with attention these will make stronger plants than larger ones, which are more likely to receive a check. The soil requires constant stirring, owing to the packing caused by the rains and for the eradication of weeds, which are now very troublesome. All plants should be kept free of dead and decaying matter.

VEGETABLE GARDEN.

Turnips, carrots, cabbages, lettuce, etc., may be sown for carrying on during the winter months. Potatoes may be planted this month for keeping through the winter. Weeding and cultivating between the rows should be continually carried on.

FORESTRY.

If the rains are seasonable, plant out evergreen trees, such as gums, cypress, pines, etc. Fill in all blanks as soon a they are noticed, and do not leave them until the following season. Planting should be done on a wet day, or, failing that, on a dull day, or late in the afternoon. Great care should be taken to see that the trees are not planted out any deeper than they stood in the tins.

POULTRY.

All houses must be absolutely watertight, the floor raised well above the level of the surrounding ground. thus preventing water seeping in and making it damp. The birds themselves should not get wet, and no pools of water should be seen in the runs.

Foodstuffs must be kept absolutely dry, otherwise they will become mouldy and sour, causing disturbance of the intestinal tract, illness, and perhaps death; certainly a diminution in the number of eggs.

Some of the birds will now be in moult. To get them through it quickly give more sunflower seed, some monkey nuts, plenty of green food, especially cabbage, kale, etc., plenty of milk or some meat, a little sulphur in the dry mash (one teaspoonful to 1 lb.); also stew two dessert spoonfuls of linseed in a pint of water to a jelly, mix this to a crumbly consistency with mealie meal or bran and give about one desert spoonful to each bird daily. Keep the birds dry during the rains, otherwise the egg output will decrease.

Do not hatch any more turkeys till after the rainy season is over. Turkeys should not be penned up, but allowed on free range.

Ducks must be treated in almost exactly the reverse manner to what turkeys are. They should be kept in a small run; nearly all their food should be wet mash, bran, pollard, mealie meal, meat meal and milk, as much as they will eat three times a day, *i.e.*, they should practically be allowed to spend their existence eating and sleeping. Big duck breeders often give a fourth meal by lamplight at 10 p.m., and the first meal is given at sunrise.

STOCK.

Cattle.—Put the bulls into the herd now to secure spring calves. The bulls should be in good condition at the commencement of the service season and their condition should be maintained while they are working. This season calves should be looking well by this time and care must be taken not to over-milk the cows in consequence. Cows rearing calves should not be milked more than once a day. Hand-reared calves should be kept in dry, clean quarters. In the warmer weather they often do better if they are kept indoors until they are three or four months of age. Bullocks which are being fattened on grass should receive a concentrate ration from now onwards. During this month a protein concentrate should usually be added to the milch cows' ration.

Sheep.—Keep the sleeping quarters as dry as possible. Keep the sheep away from vleis and "rotate" the grazing as much as possible. Sheep are liable to suffer severely from internal parasites from now onwards.

DAIRYING.

During the months of December and January veld grazing is usually plentiful, and very little extra feed in the form of concentrates is required for dairy stock. It should be borne in mind, however, that heavy milking cows are unable to satisfy their requirements for milk production from veld grazing alone, and should receive a daily allowance of grain; the latter should be fed at the rate of 2 lbs. for every gallon of milk produced daily, i.e., a cow producing three gallons of milk should receive 6 to 7 lbs. of

concentrates. An excellent mixture for this purpose is one consisting of four parts maize meal and one part ground-nut cake.

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Under the weather conditions which now obtain, cream should be despatched to the creamery at least three times a week. It is of the greatest importance that cream should be cooled immediately after separation, and should be kept cool while on the farm and whilst in transit to the railway station or siding. While the cream is being cooled, it should be frequently stirred, using a stirrer with a plunger attachment. Warm, freshly separated cream should not be mixed with old cream which has already been cooled. Cool the fresh cream first and then mix thoroughly with the old cream. Gassiness is a common defect in the cream received at the creameries at this time of the year, and is caused by gas-producing organisms with which the milk and cream are contaminated. These organisms abound in mud, manure, etc., and develop and multiply very rapidly at high temperatures. Any precautions therefore which may be taken to eliminate dirt, manure, etc., from the milk and to keep the cream cool will prevent the development of gassiness.

As the night temperatures are fairly high, cheese-makers should not attempt to use night's milk for cheese-making; morning's milk plus a starter will give the best results. Gouda cheese-making operations are not usually successful at this season of the year, owing to the poor quality of the milk and the prevalence of gassiness. This type of cheese is best manufactured during March and subsequent months.

TOBACCO.

Cultivation should be systematically continued, and no foreign vegetation allowed in the tobacco field, as weeds and grass induce insect attacks All backward plants should be given special attention, and an additional application of fertiliser to hasten growth, so that the plants ripen as uniformly as possible. Curing barns should be placed in proper condition on rainy days, and all tobacco appliances should be placed in proper order for the rush of work during the curing season. Early planted tobacco may be ready for topping during the latter part of the month, and the common mistake of topping too high should be avoided. Go over the field carefully and select typical, uniform and disease-free plants for producing seed for next season's crop. All plants should be properly primed at the same time that the tobacco is topped.

VETERINARY.

Horse sickness may now be expected, especially in districts where early heavy rains have occurred. Blue tongue in sheep will also be prevalent.

WEATHER.

Heavy rain is to be looked for, and during this month we may normally expect nine to twelve inches on the eastern border, eight in the north, and seven to seven and a half as one travels westwards or southwards. At this time of the year the rainfall tends to be heavier in the eastern than in the western portions of the Colony, whilst prolonged steady rains take the place of the thunder showers which marked the earlier part of the wet season. The growing period is at its height, and high temperatures are registered.

Departmental Bulletins.

The following Bulletins, consisting of reprints of articles which have appeared in this Journal, are available for distribution at 3d. per copy. Application should be made to the Editor, Department of Agriculture, Salisbury, and remittances must accompany orders.

AGRICULTURE AND CROPS.

No. 225. Napier Fodder or Elephant Grass, by J. A. T. Walters, B.A.
No. 374. Fibre Crops—Deacan Hemp (Hibiscus Cannabinuc) and Sunn Hemp (Crotolaria Juncea), by J. A. T. Walters, B.A.
No. 429. Propagation of Kudzu Vine, by H. C. Arnold.
No. 510. Check-row Planting of Maize, by H. G. Mundy, F.L.S.
No. 545. Artificial or Synthetic Farmyard Manure, by H. G. Mundy, Dip.Agric., F.L.S.
No. 550. Onion Growing under Irrigation, by C. Mainwaring.
No. 568. The Treatment of Arable Lands, by G. N. Blackshaw, O.B.E., B.Sc., F.I.C.
No. 598. Drought-resistant and Early Maturing Crops for Areas of Late Rainfall, by C. Mainwaring.
No. 630. The Storage of Seed Potatoes, by H. C. Arnold.
No. 634. Barley, by P. V. Samuels.
No. 643. Noxious Weeds in Southern Rhodesia, by F. Eyles, Botanist.
No. 650. Coffee Culture in Southern Rhodesia, by G. W. Marshall, Horticulturist.
No. 651. Two Important Leguminous Crops: The Velvet Bean and Dolichos Bean, by C. Mainwaring, Agriculturist.
No. 663. The Use of Fertilisers and Manures in Southern Rhodesia, by A. D. Husband, A.I.C., Chief Chemist.
No. 672. Hay-making in Rhodesia, by H. G. Mundy, Dip.Agric., F.L.S.
No. 674. Top Dressing of Maize against Stalk Borer, by H. C. Arnold.
No. 681. The Sunflower (Helianthus Annuus) (Revised), by S. D. Timson, M.C., Dip.Agric.
No. 694. The Edible Canna (Canna Edulis), by D. E. McLoughlin.
No. 695. The Castor Oil Plant (Ricinus spp.), by S. D. Timson, M.C., Dip.Agric.
No. 697. Results of Analysis of Samples taken under the "Fertilisers, Farm Foods, Seeds and Pests Remedies Ordinance" during the year 1927-28.
No. 704. The Importance of Research on Pasture Improvement in Southern Rhodesia, by A. D. Husband, A.I.C., Chief Chemist.
No. 705. Suggested Cropping Programmes for Farms on the Sand Veld, by D. E. McLoughlin, Assistant Agriculturist.
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